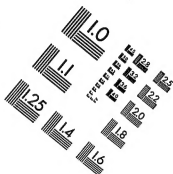


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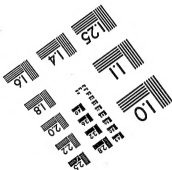
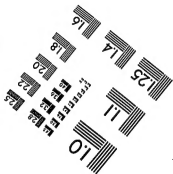
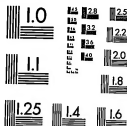
MS303-1980



Centimeter



Inches



# Thomas A Edison Papers

A SELECTIVE MICROFILM EDITION

PART I  
(1850-1878)

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**START**

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## UNBOUND NOTES AND DRAWINGS

Unbound notes and drawings are organized by year and within each year by subject. Undated notes and drawings, organized by subject, follow the dated material. The following folders comprise this series:

NS-73-001	Telegraph
NS-74-001	Telegraph - General
NS-74-002	Telegraph - Notes and Essays
NS-75-001	General
NS-75-002	Telegraph
NS-76-001	General
NS-76-002	Telegraph
NS-76-003	Telephone
NS-77-001	General
NS-77-002	Electric Pen and Duplicating Press
NS-77-003	Phonograph
NS-77-004	Telegraph
NS-78-001	General
NS-78-002	Acoustic Devices
NS-78-003	Carbon Rheostat
NS-78-004	Chemophone
NS-78-005	Electric Light
NS-78-006	Ink for the Blind
NS-78-007	Phonograph
NS-78-008	Phonometer
NS-78-009	Tasimeter



NS-78-010      Telegraph

NS-78-011      Telephone

NS-78-012      Voltmeter

NS-Undated-001 General

NS-Undated-002 Chemical

NS-Undated-003 Electric Light

NS-Undated-004 Phonograph

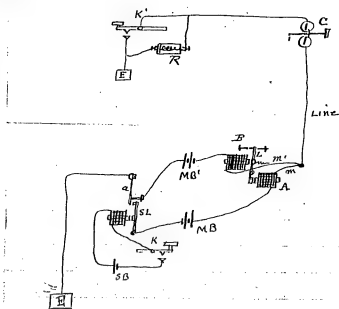
NS-Undated-005 Telegraph

NS-Undated-006 Telephone

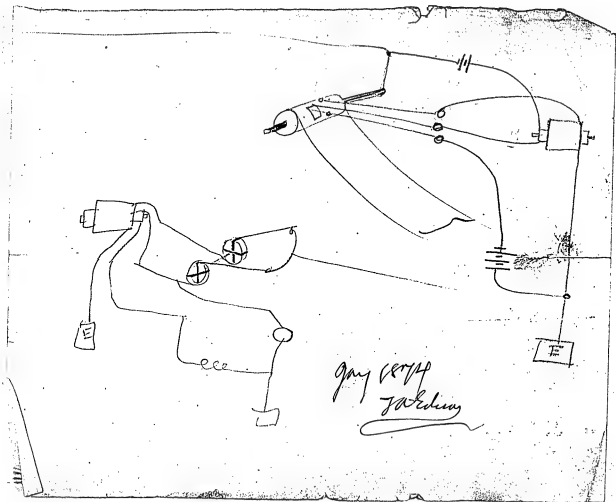
1873. Telegraph (NS-73-001)

Case "H"

[1873]  
[Duplex telegraph]



1874. Telegraph - General (NS-74-001)



10 Roman  
1000  
Carroll

(10)  
10 is the drum by which the  
Chemically prepared paper is drawn  
forward a b c d is the four  
winding pens, c d are set the  
length of one letter ahead of  
a b. ~~E~~ was lead from A B to  
The ~~Cum~~ changing roller Contact  
roller D C, <sup>also</sup> was lead from  
C D to the Contact roller and  
B A. These Contact rollers  
are so positioned regarding the  
two toothed wheels 2 & 3, which  
are insulated from each other  
the while at rest, neither set  
of roller have Contact with  
the teeth of either wheel  
but while in motion C D  
first comes in Contact with the  
two teeth of the wheels 2 & 3,  
~~the~~ (these wheels are  
connected one with the

line the other with the Earth<sup>(1)</sup>  
through the points 4 & 3-)  
after they leave the teeth B & A  
pass on a tooth, at no time  
is C-D & A-B on a tooth  
at the same time, It will be  
noticed that the recording  
pens a-b. are first connected  
with the line & ground by  
D.C. and record half of the  
letter, then the pens c-d. are  
connected to the line &  
Earth by the points A-B.  
recording the other half-  
when this is done a new tooth  
on the Escape wheel & will  
come in contact with the  
line & of the ~~other~~ Magnets  
& the wheels<sup>2,3</sup> which are

(12)  
Carried around by friction  
only will be arrested while  
the drum 10 will keep on  
at the moment the current  
changing wheels are stopped  
The Magnet receives a  
new impulse from the  
large hole in the perforated  
paper it releases the wheels  
2 & 3 & another letter is  
printed,

I shall probably claim:

The arrangement of the  
transmitting jaws for sending  
~~P & A~~ Current to sub as set  
forth & for purpose specified  
~~the use of a reg.~~

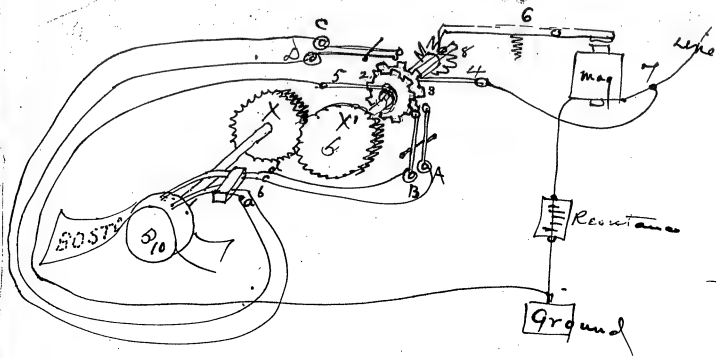


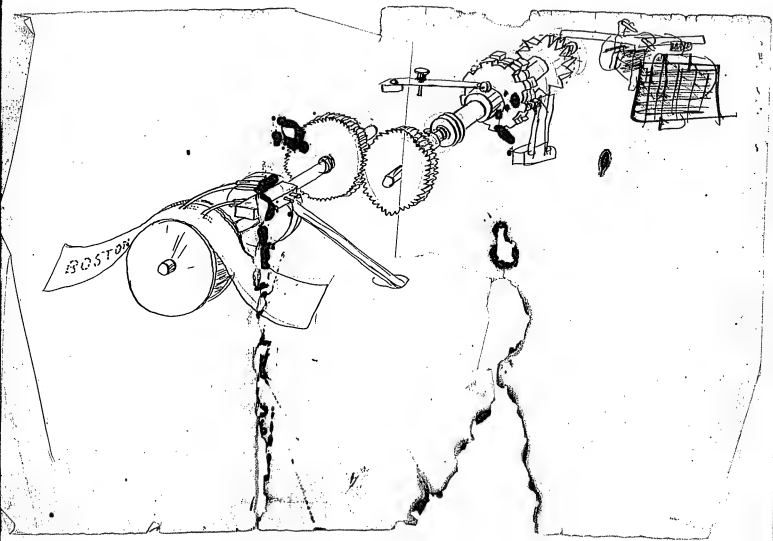
(13)

2. The use of an extra perfumation  
in Roman letter perfumed strips  
for regulating the distant  
resounding machinery after  
each letter word or number of words  
3rd. The Circuit changes or  
its equivalent for the  
of fresh,

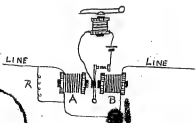
Edison

Feb 1 1874





Feb 3 1874



asked that when the line is closed or opened the lever stays  
 in position. When the line is placed, A is shunted by a  
 resistance. The power of the coils on A, are greater than  
 B but the resistance shunts some of the current &  
 makes A only equal to B. Now on opening the  
 discharge from A circulating within the short  
 circuit formed by R, prolongs the time of its  
 demagnetization enough to put the armature  
 towards it on closing the Effect of the  
 Induction (self) in A being within a cl  
 ckt prevents for an instant its magnetiza  
 hence the lever is attracted by B

Notes. 1

When testing a long magnet for induction  
it must be perfectly straight & the current  
in its helices otherwise the  
mark will be very irregular  
caused by the most minute disturbance of the  
magnetism of the cores creating secondary  
inductive discharges.

---

If a nearly exhausted battery, or one which  
is subject to polarization be placed in perm  
connection with the primary helix of a  
induction coil, a continuous discharge  
be detected in the Secondary coil by  
walking across the room. ~~the~~ the lead  
disturbance of the battery will tend to de-  
crease & increase for an instant its strength,  
hence these Secondary discharges.

---

If a very long magnet with a great  
number of convolutions be placed in

2 notes.

with a delicate mirror. 9  
Dye (Glycer - fig - )  
A be filled by one  
a simple disk of zinc &  
in Sal Ammoniac, a  
battery which is powerfully polarized  
and the whole apparatus placed on  
Masonry. So as to secure perfect quiet  
The sound of the human voice will  
be propagated through the air will be  
different to depolarize the battery  
for an instant and thus increases  
strength of the current passing to  
the Long Magnet sets up an induced  
current which an and the spot of light  
will move several degrees on the scale  
See if it will.

loses a  
in a  
they power that the  
to give signal  
The addition of the  
of two grave battery be used  
if the R of the sounder is small will  
prevent the lever from working. The current  
is so powerful that the platinum  
points are held together with ~~consequence~~  
a force greater than that acting  
the relay. Illustration Relay 300  
Circuit. 10,000 ohms 1 Cell Dot  
Signals — dots per minute. On  
addition of the local <sup>grave battery</sup> sounder  
no signals could be received. To  
too — dots per minute The resistance  
was reduced to —  
By ~~using~~ inserting 2 Daniells in place  
of the grave, the resistance was  
reduced only to — and with  
10 cells of moist ~~saturated~~ high carbon

Notes 1-

R. Daniel batteries were used in  
Connection with a Sondu af high R.  
no appreciable difference was  
obtained whether the <sup>Leve</sup> circuit was  
connected or not.

---

When a strong Grove local is passed  
through a relay lever adjusted very  
fine a slight the current produces  
a magnetic effect in the armature

If there be a slight permanent  
magnetism in the Core of the Relay  
of the the same polarity as that  
induced into the armature by the  
passage of the local current

The lever of the relay will vibrate  
with great rapidity providing the  
Spring is very slack - If the  
By reversing the direction of the



- notes - 6 -

Local current through the relay lever.  
the vibration will cease =

Tapping <sup>dot</sup> on a morse key gives two  
breaks to every dot or dash. ~~at the~~  
in making a dot, the moment the  
lever touches the contact point  
it rebounds and closes again, This  
may be detected by the inductive ~~to~~  
charges from an electro-magnet see  
fig - Chap - it is probable that  
the lever rebounds several times in  
forming a single dot thereby  
making several breaks of the  
circuit. The inductive charge of  
an electro-magnet is very sensitive  
to these breaks because the time of  
magnetization is increased. These  
principles of this rebound is very much

Snails,  
rebounds, & so on. This will take place  
when the sounder lever is prevented  
from working, the latter producing the  
result by jamming the ~~late~~ ~~instrument~~  
tells,

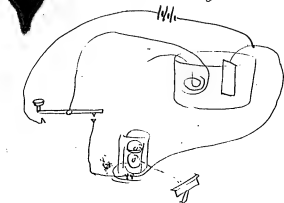
The Grove Battery may be worked on  
the Gravity plan. The platinum like a  
Calland the Zinc being placed at  
the top of the jar & the platinum  
at the bottom a short distance  
from the bottom, the Nitric acid.

The jar being nearly filled with  
water, the Nitric acid is  
poured through a glass pipette or long  
tube funnel to the bottom. The  
internal R is greater than in  
the usual form. but it gives off  
no fumes & is very constant.

The difference in the height, is entirely prevented by  
the position of the jar, at the point where the acid enters  
the bottom of the jar.  
Belomate Pot does not  
give as good results,

9. ~~15.1~~ 10.12 Nolis

(Leakage Test - for high insulated GuttaCore  
shunt Linings -



200 cells 10-minutes, press down Key. The  
leakage will charge the tub as a secondary  
battery, so when you let Key go, the  
Current flows through Mirror, The Copper  
core of Cable forms one plate of Galva  
Secondary battery & the regular Cop plate  
The other Pole of Battery = try

10 notes,

~~A 6 ohm sounder may be worked from the two cell main line Grove battery without interfer~~

~~The induction current of~~

Ten cells of battery ~~of~~ 5 of which as opposed to the remaining 5, so that no current is generated, act as secondary batteries to any other battery, yielding a current in the opposite direction to the battery current.

It is probable that no galvanic current is continuous but is composed of an immense number of vibrations, waves or pulsations, the continuity of which is dependent

11 notes

upon the amount of matter of the  
batter themselves and in their  
neighborhood. Subject to static  
friction, The greater the mass  
of matter the more continuous the  
current just as on the Atlantic  
to a long submarine cable  
of great inductive capacity;  
Several hundred sets  
made at one end gives as  
continuous current at the other.  
~~Were it possible to obtain a~~  
~~powerful battery of small surface~~  
a

10 Cells of battery Connected  
within a closed circuit with  
with a single cell with its  
poles opposed to the 10 Cell  
will remain unaffected until,  
the ~~current~~ 10 Cells are nearly  
Exhausted,

## 12 Notes

The R. of - Ferrid paper is —  
 " " 16 to gal iod Kali. —  
 2 " " —  
 Logwood formula —  
 4 var. Sols are —  
 ferro — <sup>upper</sup> Gilly —

With delicate protoxide of iron solution for chemical paper the oxide formed by the action of the oxygen of the air on the pen is sufficient to give a light continuous mark but this is not practicable at very high speeds.

Dots & Dashes recorded on iodide of potassium paper may be transferred to a like paper by a slight pressure & to dry paper by a heavy pressure —

hard drawn platinum gives the least spark -  
 may be drawn <sup>nearly as</sup> hard as — what still

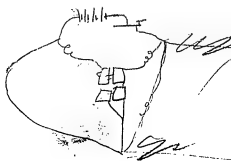
New Carbons for Bunsen battery ~~generally~~  
 have an average resistance of — ohms  
 which decreases gradually to — ohms  
 in — days. ~~Constant~~ <sup>constant</sup> use on  
 short circuit =

R of new porous cups averages — ohms  
 which fall to — ohms in —

The Evaporation of a Gravity Battery is  
 best prevented by a wooden cover  
 fitting loosely over the tops of  
 the jars

The spark due to short circuiting a large  
 low R battery in which there is no  
 Electromagnet may be almost  
 annihilated by the addition of 50  
 ohms within that portion which forms the  
 short circuit —

Feb 6- 1874

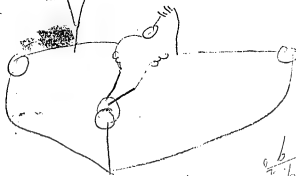


$$\begin{array}{r} 482 \\ 2 \overline{) 964} \\ \underline{4} \phantom{00} \\ 56 \phantom{0} \\ \underline{56} \phantom{0} \\ 0 \end{array}$$

$$\begin{array}{r} 21 \\ 2 \overline{) 42} \\ \underline{4} \phantom{0} \\ 0 \end{array}$$



$$\begin{array}{r} 192 \\ 2 \overline{) 384} \\ \underline{38} \phantom{0} \\ 0 \end{array}$$



$$\begin{array}{r} 822 \\ 2 \overline{) 1644} \\ \underline{16} \phantom{00} \\ 0 \end{array}$$

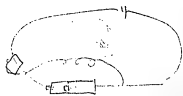
$$\begin{array}{r} 61 \\ 2 \overline{) 122} \\ \underline{12} \phantom{0} \\ 0 \end{array}$$

$$\begin{array}{r} 54 \\ 2 \overline{) 108} \\ \underline{108} \\ 0 \end{array}$$

12



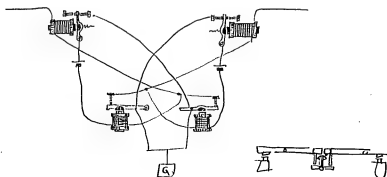
J. A. Edison Invent papers  
= 4 Diagrams



8971

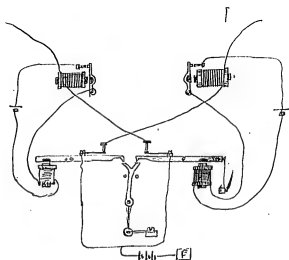
.1. Feb 74

John J Speeds Repeater.  
study it out Shaffner 495-



Farmers Repeater

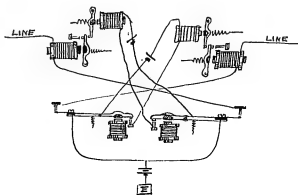
Shaffner 736.





Milliken's Rep. page 50.

2  
Feb 14



Bunnells Repeater -

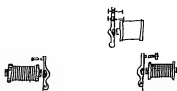
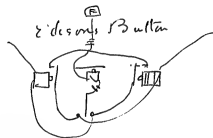


figure Bunnells Repeater  
better  
page 52



4 July 14  
~~each day~~ but with the ~~double~~ retractable Double magnet Relay any slight difference may be equalized by adjusting the magnet A. to or from the armature, That magnet being provided with such a device.

~~The~~ and the equation made without the Cores of more than one word.

The defects of this relay consists  
1st. approaching <sup>of the armature</sup> ~~the~~ either one or the Cores of the Electromagnets when the outgoing Current is on gives that magnet a greater power over it —

2nd. The most serious evil arises from the fact that the Route for the Self induction Currents generated in A. ~~have~~ are generated on a circuit having several thousand Ohms Resistance hence their Effect upon the ~~for~~ charging & discharge <sup>time</sup> of the magnet A. is very small. On the other hand, the discharge Route for the Self induction Current generated in the magnet B. ~~owing~~ to defective insulation ~~has~~ a much

shorter circuit to <sup>Feb 14</sup> discharge in  
hence its ~~electromotive~~ strength is  
greater and its tendency is to  
~~prolong the magnetic line~~ on closing  
to prevent the magnet B from being  
instantly magnetized while the  
~~discharge~~ ~~charge~~ from A, having much  
charges almost instantly, this of  
course tends to draw the lever  
for the first instant strongly  
towards A. When the current is  
permanent. The ~~induction~~ induction  
currents have subsided &  
both magnets attract the  
armature with equal force  
now on opening. A almost  
instantly loses its magnetism  
while the discharge from B,  
still continues to circulate  
through B & the circuit formed  
by the line & derivations due to  
leakage & prolongs the magnetism  
of B beyond that of A.  
This of course for the first instant  
gives the lever a bias towards B.  
The greater the escape the more perceptible  
this difficulty will become,

1 Notes Feb 15<sup>th</sup> 1894.

~~Self~~  $\rho$  ohm is equal to the resistance  
of a column of pure <sup>max</sup> conducting square millimetre section & about  
120 ft. metre long at 32 Fahrenheit  
A Siemens unit is about  $\frac{98}{100}$  of a  $\rho$  ohm.

If in a telegraph wire 400 miles in  
length all conditions the same, if  
the total amount of static charge  
be equal to 16 then by dividing the  
wire up into 4 parts of 100 miles  
each that part furthest from  
battery will have a charge of 1 part  
the next will have 2 parts, the next  
3 parts & the next 4 parts.

Hence, centre of accumulation of  
static charge is 120 miles from  
battery.

The quantity of inductive electricity  
accumulated on any telegraph wire  
if say 400 miles in length

2 Notes Feb 18 74

is proportional to the diam. of wire, its distance from ground, number of wires on the pole, distance of wires apart, mass of matter in pole & insulator. The time that this accumulation will practically last after the battery has been disconnected is in proportion to the resistance of the wire itself & all the derivation formed by the leakage.

The dichromate ~~an~~ cell whose  $\text{Co}$  plate is immersed in conc. sol of sulph of  $\text{Co}$  & whose of  $\text{Zn}$  is immersed in dilute of sulphuric acid of the proportion of 1 -  $\frac{1}{4}$  is now usually adopted as the unit of E.M.F.

Saltine 317.



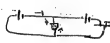
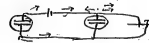
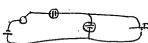
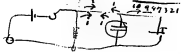
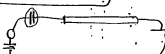
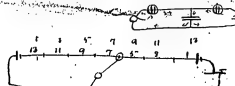
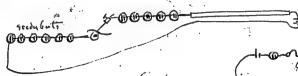
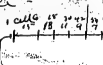
3 N.Y.  
Feb 14

Forbes method of comparing  
the electromotive force of 2 elements  
consists in measuring the intensities  
of 2 currents when  $R$ 's are equal.

He employs a galvan. with fine  
wire & many convolutions wound  
& places this Galvan. + battery in a  
circuit of large  $R$  say 10,000 ohms  
in order to be able to neglect the  
 $R$  of the element itself.

1874

Feb 17. Cable

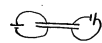


15  
7 0

17  
7 8



11  
6

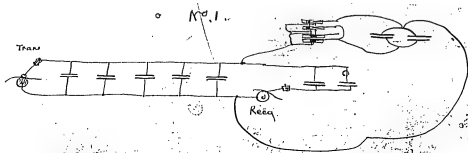


0 1

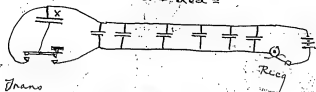


May 16 1874.

Experiments par Société du Cable Transatlantique Français  
Par Mr Edison & Batchelor



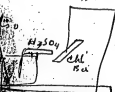
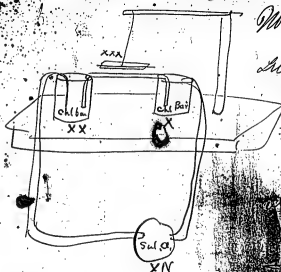
x is of same Capacity as now used on end  
viz 1 Binder & Red



Dark Resonance

Nov. 2nd 1894

Send this  
(No Grod)  
C & B



drop the  $\text{SO}_2$  on  
the  $\text{chiba}$

XX, chiba

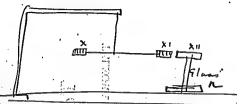
XX also  $\text{H}_2\text{O}$  &  $\text{O}$  in

XXX, Ch Bar

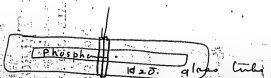
also  $\text{H}_2\text{O}$  in XX & X.  $\text{SO}_2$  in XX  
&  $\text{SO}_2$  in XN. Chem. ought  
to draw XXX from right  
angle to parallel

4

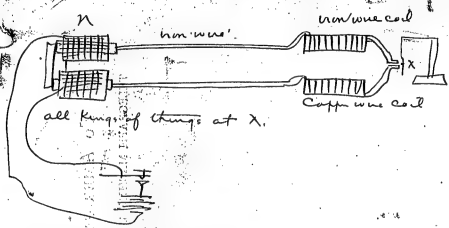
also try the way,



X & X are pair of paper mounted with the  $\text{SO}_2$   
and around to piece of glass rod, also to  
metallic rod. X is a standard  
with glass rod, on top is X" a pair of  
paper mounted with another solution,



Nov 2 - 1874

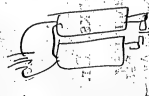


N. B. etc. Copper disk quantity magnet here with quantity magnet  
 dispense with Copper coil & iron coil  
 used large iron wire 50 feet long  
 both ends also do. Copper wire,  
 also wet string & iron wire, string  
 mounted with various chem. salts,  
 also copper wire & wet string  
 also close these various conductors  
 of Ed. Magnetism to gether when  
 X is attached  
 when current is on break contact  
 of iron or copper from cases of magnet



Cons. of N. Coils, to apparatus &  
 regular way - also used 1 iron  
 & 2 Copper wire,  
 also wet string, organic conductors,  
 wire coated with various chems,

also shield  
 No 1 & 2  
 etc.



string of paper wet in  
 various acids et al  
 decompose in air  
 by battery see if  
 pyrogallic & good K  
 drawn in various fluids  
 also connecting to oppose

To

TELEGRAPH

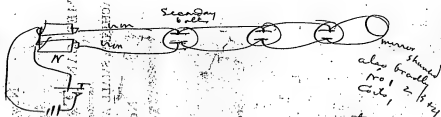
6

also send reverse current.

Try it X tube, with various chems

Also connect the two helix of  
electromagnet opposite each other  
oppose & produce no magnetism  
and try all over again

the



Core of N connected to opposite &  
reverse way — also used 1 iron  
core also 2 copper wire,  
also wet string, organic conduct,  
also used with various chems,



strip of paper wet in  
various acids etched  
decompose in air &  
by battery see if good K  
pyrogallic in many acids find  
decomposition to oppose

7 Nov 2<sup>nd</sup> 1944

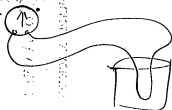
shellac  
glass

Tubes with hydrocarbon,

Tubes with metal inside with acid  
attracting them —

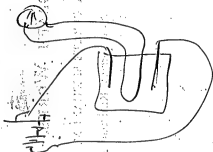
Salt crystallizing —

mirror

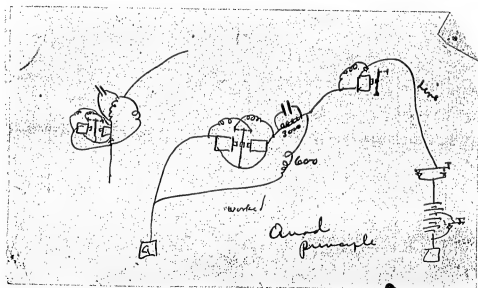
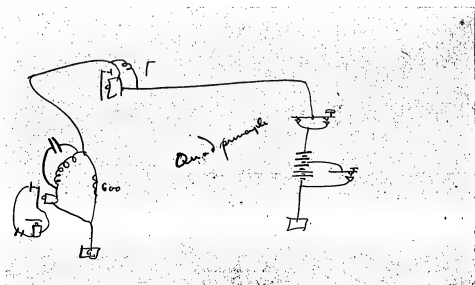
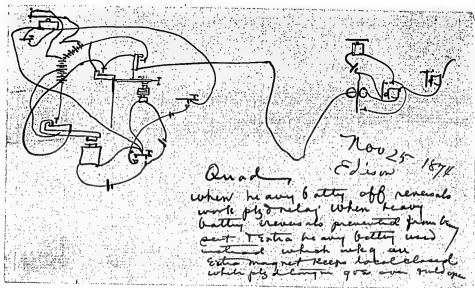


Various chemicals  
with loops of  
various wires,

precipitates formed & crystallizing also  
acid to attract metal inward,  
also this



Exp. found some  
new phenomena





1874. Telegraph - Notes and Essays (NS-74-002)

This folder contains notes and drafts for a proposed book or series of essays by Edison on telegraphy and related electrical subjects. Similar material can be found in NS-74-001 and NS-Undated-005, Unbound Notes and Drawings; in Laboratory Scrapbook, Cat. 297; in Laboratory Notebook, Cat. 30,099; and in Laboratory Notebook, Cat. 1176. The essays on duplex telegraphy (items 4-6, below) appear to have been prepared for The Operator, Vol. 2, nos. 1, 3, 6 (1874). The essay "On the Effect of Self Induction . . ." (item 19, below) was prepared for The Telegraphic Journal, according to a docket on the back of one of the pages. The following is a list of the documents in this folder:

- 1) "The author of this work . . ." (1 page; incomplete).
- 2a) "Notes & Ideas for Book." (3 pages; Edison's hand).
- 2b) Transcription of (2a). (1 page).
- 3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).
- 3b) Pages 1-11 of (3a) in Edison's hand. (38 small pages).
- 3c) Transcription of (3b) plus some additional material. (18 pages).
- 3d) Pages 13-15 of (3a), here numbered 22-29, in Edison's hand, preceded by different material on pages 20-22. (10 pages).
- 4) "We will suppose that . . ." (7 pages; incomplete; Edison's hand).
- 5a) "The effects of the transmitting battery . . ." (14 pages; incomplete; Edison's hand).
- 5b) "The Duplex principle . . ." Another version of (5a). (9 pages; incomplete; Edison's hand).
- 6a) "In a Duplex apparatus . . ." Transcription. The last page transcribes the first of (3d). (12 pages).
- 6b) Pages 1-7 of (6a) in Edison's hand. (11 pages).
- 7a) "Induction Relay." (9 pages; incomplete; Edison's hand).
- 7b) Transcription of (7a). (4 pages).
- 8a) "Morse Telegraph contends with Line," page 2. Transcription. (1 page; incomplete).

- 8b) This appears to be a continuation of (8a) in Edison's hand. (1 page).
- 8c) Transcription of (8b). (1 page).
- 9) "Chemical paper . . ." Transcription. (3 pages).
- 10) "In the American System . . ." Transcription. (2 pages).
- 11) "Printing Telegraphs." (9 pages; Edison's hand).
- 12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.
- 12a) "Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).
- 12b) "Break Wheels." Another version in Edison's hand. (5 pages with Batchelor's annotations).
- 12c) Pages 16 (2 versions), 17, and 18 of (12a) or (12b). (4 pages; Edison's hand).
- 12d) Draft essay on breakwheels by Batchelor. (12 pages; incomplete).
- 12e) Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).
- 13) "Electromagnets." (4 pages; Edison's hand).
- 14) "The laws which govern . . ." (2 pages; Edison's hand).
- 15) Incomplete essay, pages 9, 12, 14, and a damaged page. (4 pages; Edison's hand).
- 16) Incomplete essay, pages 21-23. May be a continuation of (15). (3 pages; Edison's hand).
- 17) "Edisons Inductorium." (13 pages; Edison's hand; page 5 missing).
- 18) "If a current be sent . . ." (1 page; Edison's hand).
- 19) "On the Effect of Self Induction . . ." (4 pages; Edison's hand).
- 20) Three pages of fragments from essays in Edison's hand.

The author of this work does not propose to merely reproduce on its pages that which has already been published upon this subject nor to describe elementary <sup>com</sup> electricity. Nor is it the purpose to put before the public a collection of elaborate and difficult problems <sup>in</sup> electricity. But the object is to simplify that which appears to be so little understood upon this subject. The author proposes to do this by presenting to the public in this work a series of experiments as performed by him. Having been for a number of years actually engaged in experimenting <sup>in</sup> telegraphy and electricity in general the author also will explain numerous observed phenomena in electricity they having been noticed by him and which is not generally known

Notes - (1874)  
+ Ideas for Book.

Where very delicate currents are used  
to move the armature lever of a relay  
the magnetic effect of the passage of  
the local current through the  
local points will stick them together  
by using a ~~high R~~ <sup>high R</sup> Daniel of ~~2~~  
cells ~~or even 1 cell~~ for the local  
current. Signal at 30 words per  
minute were recorded on read  
on using a very delicate relay  
worked by 2 cells through a  
high Resistance - When two  
grove cells were substituted  
for the two Daniel in the  
local circuit the

~~No <sup>great</sup> intelligible signals~~  
 Could be received. The magnetic  
 effect of the powerful current  
 passing through the contact  
 points was greater than the  
~~retractile force of the spring~~  
~~retractile~~ effect of the  
 current passing through the  
 relay.

add MORE

The British Post Office Dept  
 refused permission to use  
 a Grove battery on their  
 Lines

Try Resistance with Mirror  
 Galvanometer of a glass  
 tube filled with finely  
 powdered sesquioxide of  
 Iron also with powdered  
 peroxide of iron.



not enough force to the water  
 to overcome the angle of  
 X & wash it

No 1  
Notes  
and Ideas for Book

Where very delicate current are used to move the armature even of a relay the magnetic effect of the passage of the local current through the local points will stick them together by using a high R Daniel battery of two cups for the local circuit signal at 30 words per minute were read on a very delicate relay worked by 2 cells through a high Resistance - when two grove cells we substituted for the two Daniels in the local circuit no intelligible signals could be received the magnetic effect of the powerful current passing through the contact points was greater than the effect of the current passing through the relay - add more

The British post office Department refused permission to use a grove battery on their line  
Try Resistance with Mirror galvanometer of a glass tube filled with finely powdered sesquioxide of iron also with powdered peroxide of iron  
Not enough force to the water to overcome the angle of X wash it



No 1.

Notes [COPY- ORIGINAL BY T.A.E.]

neutralizing escape show Kromer Method in a new form  
show Smiths arrangement in good form show 3 modification  
of my, W.U. arrangement.

Say Broadly gold plate rubbed with cloth will electrify the  
needle and cause it to stick to metal circle may be  
discharged by lay the flat of the hand on it - show good cut  
also separate cut showing coils and needle off

Polazed Relays the lan being polazed by a small constant  
battery, M. C. - etc - clockwork battery charger for -  
cut and description Walkers - burglar alarm - 1 dozen

good escapements, 2 or 3 good unisons Self Starting  
register Register Repeater by lever and Embossed paper  
Duplex - having sending receiving his own writing back

my two ways duplex cut and description with way stations  
description and cut my battery also results of escapements  
on preventing of diffusion if that is not so then the reason blue

kept down cause the action takes place right at capstan and  
blue notal used as fast as it tend to rise when in old  
Magnets no action takes place on rising fluid but way

down at bottom Test that spring pulling with and pulling  
against effluen why That induction be greater on lines  
whose poles dont make good Earth for in that case the

distance from one wire to the other goes over the same  
material that it goes to the ground hence if the pole




no 2

be very dry and makes poor earth on closing conduction  
takes place across the axes but quickly cease  
owing to the polarization of the contact part of the wire by the  
moisture of the wood this would explain this great  
induction on the overland wire running through dry dust  
one of the reasons why receiving on a ground wire is not  
uniformly successful is because of return currents from  
other wires which which when exactly equal works the  
relay open when distant man closes and when not equal  
reduces the effective working strength of the distant current  
Secondly to the variations of the return leakage owing to  
the nearness of the feeding batteries this cause of bad working  
in Duplex balances the leakage is done by the plan now used  
but not on Duplex I was told at Greenwich that earth  
current on a cable sometimes potential so D and C cells  
changes from N to P sometimes in less than  $\frac{1}{2}$  minute

spark due to a great number of magnets in circuit  
may be openly annihilated by putting square foot of  
tin foil each etc etc placing thick pieces of paper  
between armature and screwing magnet up close so as  
to get core near armature and use powerful spring  
of paper get very feeble signals

 Painted platinum points make better

no 3

contact and longer than flat  because in this case that oxide has a clearance but with flat

points it has not -

Compressed platinum hydroline on very hard drawn gives less spark best for inductance. Idea that sounder points close circuit better than relay etc gold-leaf upst etc - show loss of part of signal by changing line

Why spring points should be used about rebound of all keys - proved by the quick fall of currents generating and break in induction of magnet in bridge showing when held in full power with spring light


had connection in revolving shaft - vibrating points best Compressed are sounder for secondary battery induction of condenser cable Lyden gas secondary chemical action At Cable



Say chemical recorder splendid instrument for investigation by comparison

Secondary battery shunting a relay Describe effects show cause currents



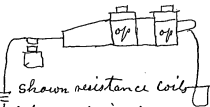
and this  ER

Automatic Plan of putting number way office on wire and get signals from main Relay -

No 4

Work up System of Repeater repeating so as to combine number of branch offices with main office message received Embossed and transmitted one main wire from Embossed strings - Say plantation strong paper used and peculiar high inbreeding - Say old G. and S. Relays although only  $3\frac{1}{4}$  large retarded speed waves Authors short slotted relay ~~allows~~ allows of nearly double no waves be used too used by Gold and stock Effect played yet not.

See if in movement present of acting by vibrating P and reverse coils double in electromagnet



of Kansas Stone and plumbago graphite also in glass hard rubber etc = mention where a wire may get grounded through local connections with battery an floor damps place office wire for local running in damp walls over gas pipes etc = Some magnets used at Louisville having a total length 11 inches worked bad on dry day say nothing of wet day secondary battery action on land wires How working with a heavy battery through a weather opposing battery gives weak currents in closing - P. and A. test Dec 27

Compensating Defects of reverse currents where strong enough to fully clean the wire and give an excess -

No 5

My Relay worked by duplicating the polarized and working from the discharge of the Magnet -  
Why a polarized tongue should lay horizontal instead of perpendicular

Woods Buton  
Aulton Buton  
Hicks old  
Hicks No 2  
Hicks latest  
Bunnell  
Haskin  
M. Haskin

dots & dash marks can be burned in  
potent at the rate of — 700 per minut  
by using a platinum wire and keeping hot  
by battery (Horn) Register may be used for  
perforating paper next to platinum for cases  
Nickel - in most instances it is as good as  
platinum and very much cheaper  
It is used for contact rollers in perforated  
paper transmission and gives good contact at

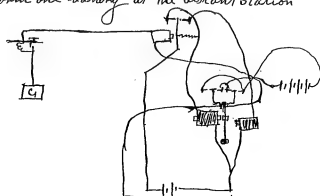
3000 words per minut

This discharge from the Magnet in a  
wheatstone receiving must interfere with the speed shown  
chemical records - The reason why the spark is so much  
greater on a local current with a grove or carbon battery  
change with a Calland of the same strength is owing to the  
greater internal resistance of the — by short circuit  
a more telegraph battery composed of grove or carbon  
battery we obtaining a dazzling electric light but if 20  
comes on even less be inserted as a part of the short circuit  
wire the spark is only just perceptible - this extra resistance

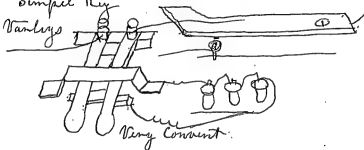
No. 6

is inherent in the Signal here for local circuits in different apparatus when a great number of contacts are made the Calland should to use movement.

Paper had it Method of getting reversal on a line at one station when from one battery at the distant station



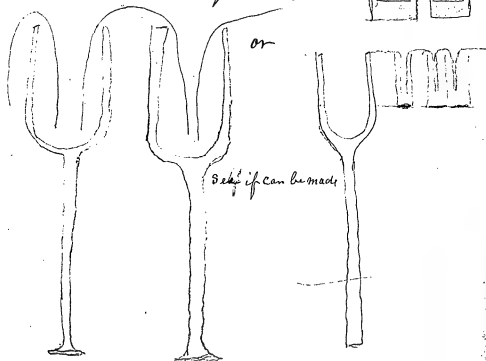
Paper - P 19 - to make the ordinary Red fluid - 1 gallon Sal. 3 gal water in separate vessels dissolve 5 lbs Bichrom in 2 gal boiling and add to the strength through the proportions of Potash sometimes made greater to make a more granulating fluid add one gallon water Sat Colbich to one gallon Sal a Simple Key Reversing Key Vanleys



No 7

Very weak receiving currents sometimes the permanent magnetism  
is equal to received currents in that case the relay opens when  
Key closed & Reversed current translator differs  
open ckt separation several RR signals get description from  
spring Just batteries

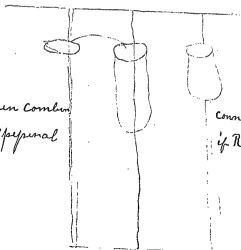
when better insulator required This



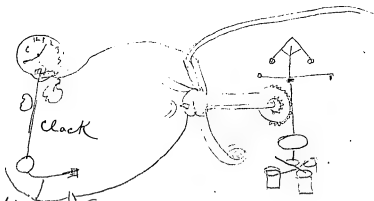
No 8  
Simple Galvanometer



get good cut of Amm comb  
instrument. Phelps good Spinal



connected see  
if Rods work



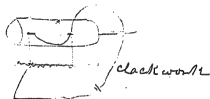
Securants Self adjusting Relay Sumers polarized relay  
Thomsons : Minor good reversing Key Self closing Keys  
Van Hooasaberge unison Van Hooasaberge rattle Sounder  
Switch boards all kinds  
Magnetism when testing long magnets  
dont shake floor to increase Electric battery get bad results  
dont test magnets within several feet needle

No 4

mention proposed by little weaker signals so as to not  
show static - say how works but this already done by

— will bring little results - Some persons adds  
condense - but this decreases instead of augmenting it -  
Experiments made between W. & N. Y. gave highest but  
90 w per minut on most sensitive worn paper that was  
readable good rain produces his results in long currents -  
have a half current should be sent for dishes  
Have first part of letters should be longest 0000  
Have speed increased by using European Alphabet and  
close spacing

10 Show results on paper when it is attempted to work  
until — Duplex showing automatic perforated  
paper Duplex. My perforator all new -  
Modification by Jack Kill man Roman perforator  
old paper feed. & Key perforator. Combination to  
produce Morse Characters etc roman Embossing 45 lever  
printer chemical printing machine Milwaukee Copying  
machine



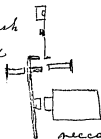
Thick ink from filings



No 10

artificial Cable - artificial cable with magnets  
 artificial " with secondary batteries gives  
 Experiments and recorded results with all - Bradleys  
 Spools - test of strength compared with SMC same R.  
 Duplex Stearns may have way stations received by  
 using a very short relay shunted = and the current from  
 the stations sending is double strength of the other  
 current - Duplex - be best when relays  
 arrange cut for that a Relay is best with

Spring points this  
 Gitta percha thole Varnish  
 to coat arms of grove and  
 other zincs in place of  
 asphaltum which



Spring try it asphaltum  
 oil on Colland battery resonance - wooden core prevents  
 Evaporation Effectually - to make carbon battery last  
 long which provides part  $\frac{1}{2}$  inch thick - Try  
 where there are several magnets in them some current  
 whose - one vibrated rapidly the stoppage of  
 any one of these - is liable to alter the  
 adjustment of the rest  
 Resistance of leakage being water  
 polarization is decreased but



and subject to  
 pitting on battery

No 11

X hence when every thing is equalled for the taking off of X will take off a electromotive force off of the water leakage

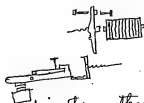
so that when the distant current comes through not so much will pass via water leakage to earth as through metal leakage but when X it it breaks down the resistance of the water draws down the X although equalled more of the distant current will pass through leakage owing to the peculiar effect of X in reducing R of water the advantage of A — Germany's current is that the leakage on cross line generally all in one direction when as other English lines we receive currents in both direction so that we a current between Nil and 30 elements and on the English lines between between 30 positive and 30 negative as a disturbing effect of 60 elements

will always be a drawback to fast systems excessive underground work as well as the close proximity of one wire to another and the use of rather wires to prevent cross currents all of which are in use in England render the system far inferior to the American — say about static charge increased

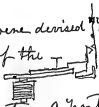
No 13

follows that the current will divide Equally upon the regular and artificial line and move <sup>1</sup> pass down the receiving instrument as the resistance on both sides is equal and there is no cause for a difference of  $L$  — if no Condenser was connected to the artificial line that portion of the current due to the static charge of the line would pass through the instrument. This resistance of the artificial line can be reduced to less than the resistance of the line and the difference compensated for by increasing the resistance of the Rheostat B. but the decrease of resistance between the one armature of the Condenser and the other of course, decreases the electrostatic capacity of the artificial line, & when signals are received the distance station more than one half of the current passes through the coil A, to the ground via H the other portion through the relay thence through B, B the ground and a small portion through d to the ground when the signal ceases the induced current from the magnet circulates within the circuit formed by A, B, C. Thus preventing the instantaneous charge and discharge of the relay and mutilating the signals in the exact proportion as the length of the coils of the magnet and number of the convolutions are increased and the resistance of the devised circuit. This effect is partially compensated for by these slight changes

No 144  
~~and~~ which are generated by the small quantity of  
 which passes to the ground through D, Mr. Stearns is  
 the inventor of another very ingenious modification which  
 is shown in figure —

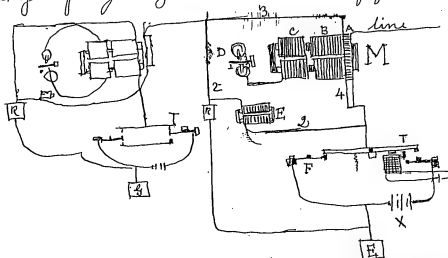


the effect of the outgoing current in this method is compensated  
 for by mechanical means, as is a lever B, a retractile spring  
 having a tension equal to the spring magnetism on the relay  
 due to the outgoing battery this lever comes in contact and  
 rests on the extension of the relay lever when the sounder  
 lever raised and at the instant the contact points separate and  
 the battery B is thrown on the line the advantages of this  
 method is that if the Equation be not perfect no extra signals  
 will be thrown in as in the double coil duplex but the  
 effect will be to require the spring X to be adjusted frequently  
 Mr. Stearns describes no method of counteracting the  
 static charge this charge may be counteracted mechanically  
 as shown in fig  
 the following methods were devised by the Author  
 and are on illustrations of the enormous number of  
 combinations which it is possible to make  
 with telegraphic apparatus a portion of them have



N. 15

Serious defects while others are while others will perhaps be found as more perfect than the methods now use the method which I shall now describe is worked entirely by induction which requires less perfection of balance and has a greater working margin besides allowing the use of apparatus which is nearly self adjusting this method shown in figures



M is a long electromagnet upon which are wound the coils A, B, in opposite directions on to another the coil A is in the main line circuit and the coil B in the artificial line R, is the resistance coil adjusted so that its resistance including the coil B, equal to the resistance of the line C is an ephray coil not in connection with either circuit the

No 16

line free ends of this coil is connected to a polarized relay  $O$ .  
 $E$  is a long Electro magnet with the armature in permanent contact with armature cones, and is connected so that that portion of the current from the battery  $X$  which passes into the artificial line, divides half passing through the coil  $B$  and the other half through the magnet  $E$ , when the Saunderson lever is actuated by closing the Key -  $R$  battery  $X$  is thrown on the line were the magnet  $E$  disconnected and there were no static charge on the regular line the two coils of  $B$  would balance each other and produce no induction current in coils -  $C$ , but if there was a static charge on the line the balance would be destroyed the cones of  $M$  would become magnetic in proportion to the strength of the static charge this would induce a current into the coil  $C$  actuate the polarized relay relay but if the magnet  $E$  is connected the current which passes through it sets upon inductive charge which circulating within the circuit formed by the wires 2, 3, 4, produce an electromotive force in the coils  $B$ , Equal to that produced by the static charge in the coils  $A$  the coils  $A$ ,  $B$  being balanced ~~on~~ are each themselves producers of induced currents when the line is very short the magnet  $E$  should be short as in that case the regular line sends short charges while

No 17  
the magnet does the same thus all effects of the  
outgoing battery are balanced and the induced  
currents generated in the coils C. actuating the polarized  
relay are due to the excess of current from the distant  
circulating in the coil A, when the strength of the distant  
current does not fall below a certain point the polarized  
relay D. is self adjusting - receiving - being worked by the  
induced induced currents above and independent of their  
strength except they fall below a certain point  
the magnet E. is infinitely more powerful than a  
Condenser in proportion to size and cost and convenience the  
author believes himself to be the first person to discover  
the merits of an ordinary electromagnet for compensating  
various in telegraphing the numerous successful applications  
which he has made of it a clearer description of the  
induction effect of the magnet E may be found in the  
chapter relating to magnets  
the next method is shown in fig and consists in  
equating post by the joint action of an electromagnet and  
retraction spring

3a) "Notes - Neutralizing Escape." Transcription. (42 pages; page 12 missing).



The Sounder lever connects and disconnects the battery,  $F$ , in the usual manner on additional point,  $K$ , is added to it at which point the local circuit is broken when the battery  $F$  is put to line whether this local circuit one ~~two~~ magnets  $A$ , and  $D$ . The Spring  $H$  is adjusted so that the lever will respond to the distant signals when the Battery,  $F$ , is to line and passing through it were the battery,  $F$ , taking off the tension of the Spring would have to be decreased in the exact proportion as the strength of the magnet,  $B$ , was decreased by disconnection by the battery,  $F$ , to get the distant signals but at the moment that the battery,  $F$ , is disconnected the local circuit is closed and the strength of the magnet  $A$  produces as force acting in the opposite direction to the Spring upon the lever the magnetism in this magnet is equal to the magnetism which had been present in the magnet,  $B$ , due to the battery  $F$  hence by the joint action of the Spring and local magnet the lever is always adjusted for the distant signals. The magnet,  $D$ , also in the local circuit acts as the primary coil to the coil,  $C$ , which is in the same line, at the moment of putting on the battery,  $F$ , the local circuit is broken at the point  $K$ , the core of  $D$ , discharges and an induced current is thrown into the coil,  $C$ , and on the line equal to and in the opposite direction to the static charge and when the battery  $F$  is

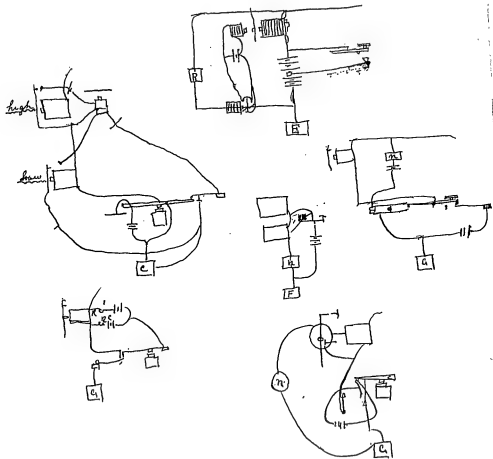
No 20

disconnected the local circuit is closed on a

Contrary charge is induced into the coil, C, and main line equal to the return static charge in this case the charge is not balanced upon the receiving instrument as in other duplex but neutralized ~~on the~~ <sup>the</sup> ~~line~~ <sup>the</sup> ~~itself~~ <sup>of course</sup> This acting upon the whole line neutralizes the charge which runs out at the other end which allows the relay at other end to discharge — and of course give better signaling <sup>in the form of duplex</sup> the charge which runs out at the receiving end tends to shorten the first part of signal and lengthen the last part. but this is prevented by compensating in this manner. The strength of the inductive charge thrown into the coil, C, should be so regulated that it will just neutralize the static charge and give no excess otherwise the distant relay will close a second time and it will also effect the home relay by increasing the coils in the local circuit induction is charges of the most powerful character may be thrown upon the line to compensate for the discharge which occurs on long well insulated circuits.

But in appendix

Put in appendix No 21

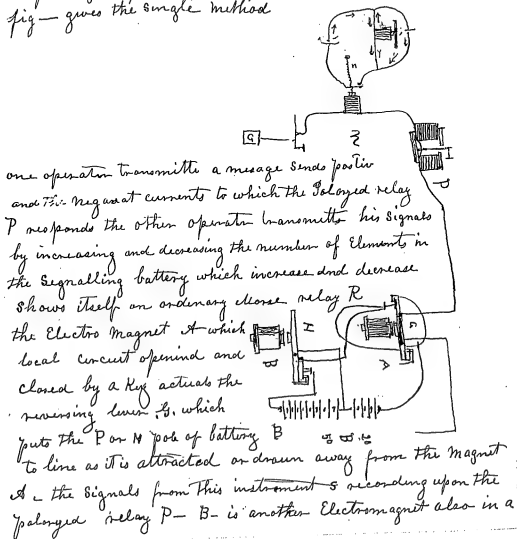


No 22

Get copies of those already patented - describe duplex  
arranged on a cable - duplex for Local circuits  
duplex a common G. A. S. private line in the  
the English reverse current way of using Starns duplex  
The author has taking great pains to test the several  
methods of transmitting two messages in the same direction  
upon one wire at the same time described in Schellen  
and others Standard telegraph works but no one of them  
will give readable signals even in the laboratory circuit  
it is very questionable whether mere theoretical instrument  
combination should be inserted in a standard work of  
Telegraphy always insurmountable obstacle the problem  
to be solved producing a practical combination of this class  
of duplex is very difficult to solve  
as will be readily acknowledged by those who have  
attempted it The value of this form is greater than the  
ordinary duplex or for instance between New York and  
Washington where the the great bulk of the business is in one  
direction and on press work it has another value which  
is that it can be doubled and form messages transmitted  
at the same time the author has devised a plan of  
sending two messages in same direction which although it  
is not him extensively introduced works very successfully  
he has also had in successful operation in his laboratory

No 218

a quadruplex plan of which is shown in page  
 in the latter instrument a slight modulation of the  
 signals take place owing to self induction but  
 will probably be found found for this end =  
 fig — gives the single method



No 24

local current opened and closed by a Key. This magnet actuates the lever, H, which in creases or decreases the number of Elements of the battery, B. The signals from this instrument are recorded on the ordinary relay, R, it will be noticed that the local battery whether it be 20 Elements or 70 Elements is reversed by the lever, P. The polarized relay, P, will respond to the reversals of 20 Elements on circuits of several hundred miles in length owing to the fact that it has no retracting spring to overcome and the lightness of moveable parts it will not change its adjustment when the number of Elements are increased to twenty hence the operation of the lever, H, will not effect the signalling due to the reversals = The relay R requires a greater force to set it in motion the armature is adjusted to such distance from the cores that the twenty Elements has no effect upon or at least scarcely a perceptible effect when the tension of the spring, S, is the least which it can be made if the spring, S, be adjusted properly this relay will close and open every time the 20 Elements are added or subtracted from the battery, B. It is obvious from the above description that the signals due to the reversals will be recorded upon the polarized relay P and those due to the increase & decrease of the electromagnetism of the reverses will be recorded upon the relay

No 25

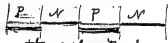
$R_1$  but it by no means follows that these signals will be perfect - The relay  $R$  must be of a peculiar character and a particular arrangement of the local circuit and sounder must be made - to overcome the difficulty experienced at the moment of the reversal of the battery this difficulty which I shall now describe was one of the great difficulties experimenting in the course of experimenting when the lever  $H$  of the magnet  $B$  is depressed permanently the armature of the relay  $R_1$  is attracted. if now while  $H$  is still depressed the battery  $B$  is reversed by the lever  $G$ , the polarity of the iron cores of the relay  $R$  must change from  $N. S.$  to  $S. N.$  hence there is a instant where there is no attraction whatever in the magnet the armature lever if the relay wire an ordinary one would be pulled away from the face of the cores by the retracting spring for an instant and be immediately reattracted against when the change of polarity had taken place this would open and close the local circuit if arranged in the ordinary way giving a false signal as this takes place at every reversal it follows that the signals would be greatly mutilated - this is obviated by shortening the length of the magnet so that its charging and discharging time shall be several times less than the ordinary magnet and increase the charging and discharging time of the local magnet when the magnet

No 26

is very short less than one inch. The polarity of the iron cores will change with such rapidity that the armature scarcely leaves the face of magnet even when the spring, S. is adjusted so high that signals are scarcely recorded and additional protection against false signals is the manner of closing the local current on the back point instead of the front point when arranged in this manner the armature must fly back and rest for an instant on the contact point before it will open the sounder magnet and then will scarcely happen except upon very long circuits of considerable capacitance the static charge increasing the time of the change of polarizing but which comprise them is possible as well be presently shown. Two local batteries are connected to the local sounder the 2 inner poles of one battery is connected to the copper poles of the other battery the sounder is placed in a bridge wire which forms a point of both circuits by tracing the direction of the current when both circuits are closed it will be seen that the bridge wire is at zero point thus being no difference of potential necessary to cause a flow of current through this wire consequently when the armature of the relay, R. is in contact with the back point both circuits are closed and the sounder is open when the armature is attracted one circuit is broken the balance is

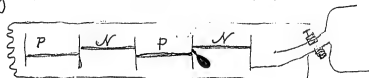


No 27

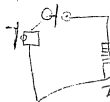
destroyed and the Sounder closes precisely as if there  
 , There were but one battery and the contact was made  
 on the front point = The fact that the Sounder is  
 allowing them a closed circuit allows the self induction  
 to react upon itself and very slightly prolong its time  
 of charge and discharge as has been described more fully  
 in the chapter local circuits the core of the polarized  
 magnet P should be very short and the magnets shunted  
 with high resistance so as to prevent the self induction  
 current going upon the line interfering with the change of  
 polarity of the relay R, = were the cores of the polarized  
 relay of the ordinary length the discharge from them  
 would weaken the first part of every reversed current and  
 were it to be shunted to prevent these currents from  
 interfering with the relay R, the currents circulating  
 within the shunt would be so powerful that a  
 mutilation of the signals would take place on the  
 polarized relay but by decreasing its length the self  
 discharge can be so reduced that it will no longer  
 be perceptible = reversed currents sent upon a circuit  
 upon which end static change takes place is recorded  
 upon chemical prepared paper thus   
 the vertical lines shows the points where the relay R, is  
 liable to open and close

No 28

long cones the current is recorded this



on when the relay, R, is short and the polarized relay, P, has long cones some effect is produced, - but when both are very short then the marks do not show any perceptible weakening the same weakening of the marks shows itself when the record is taken up on a very long line of high induction capacity the first part of positive current being with the induction change due to the previous negative - when this apparatus is to be used under the latter condition - the etc etc



see if it will -

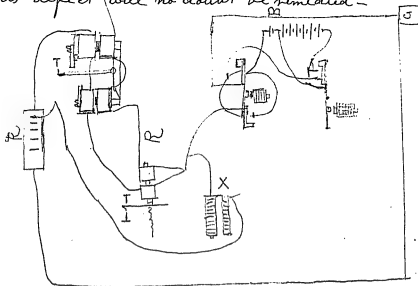
etc

the alteration to be made with this apparatus to make it a quadruplex (see if if proper) is to combine two sets to gether with double coils on each magnet for balancing the out out going elements upon the receiving instruments figure shows the connection at one station only arrangement at the other station being precisely similiar I have separated the coils in the magnet so as to simplify the connection

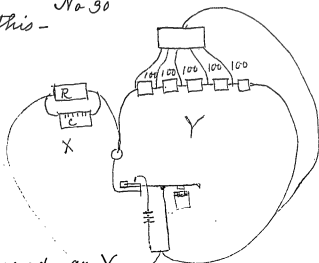
No-29

the relay, R, and P, being provided with equating coils placed in the artificial line formed by the rheostat, R, and magnet, X. (the latter for compensating all effects of the manipulation of the battery B can be neutralized on R, and P, show former duplex Key and insert in right place =

This induction action of the currents from the distant station thrown with the artificial circuit by the double coils renders the signals at certain periods of time when the four keys are being operated rather shaky but in line. This defect will no doubt be remedied -



Try this - No 30



See if X don't record - an Y

Mention that Garrett Smith one of the chief Oprs of the W U Telegraph office in New York succeeded in applying the Stearn duplex to A Combination printing which worked very successfully between New York and Philadelphia - Chemecarl paper

In the investigation of the static charge upon telegraphic circuits the chemical recorder is of great value in fact many of the phenomena attending these discharges can only be investigated with this instrument it gives reliable records of changes which takes place with great rapidity it is also of great value in determining the induction of Magnets and is as yet the only means by which a near approach of the capacity of a circuit can be obtained great difficulty was first experienced in obtaining a chemical solution

No 31

which should have great delicacy and still give marks of a permanent character paper prepared in a saturated solution of iodide of potassium in which solution there is a small quantity of flour and Nitrat. Soda - is extremely sensitive to the electric current giving a perceptible mark with one cup of battery through a resistance of 50000 ohms but the marks are not permanent great draw back in experimental investigation - ferrocyanide of potassium with Nitrate of Ammonia as given in Culley and other combination of ferrocyanide of Pot with other substances described in telegraph works are infinitely less delicate than the Iodide of potassium there bear about the proportion of 40, to, 1 - besides a polarization of the pen takes place with the other solution which tends to give capacious results.

The author formulas now used by the American telegraph constant and m co gives paper of the greatest delicacy who made in the paper movement the marks are of a permanent character and bear points of delicacy to iodide formula  
 25 38 to 40 Fourmule water double Chl of Gold and Sodium Iron or Tin pen Etc Etc direction the Ammonchloride of Sodium is a very expensive salt but as little is used the rolls of paper costs but little more than the ferrocyanide paper and several times less

No 32

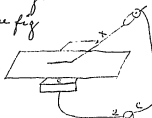
than the Iodide of potassium paper - the wet paper will have a light yellow color and the mark will be of a rich purple and very permanent no polarization of the pen takes place with this solution - an other formula possessing nearly the same delicacy and much less effusion and which gives marks of a permanent color is  $\frac{1}{2}$  ounce of the ferrocyanide of potassium one gallon distilled water 1 lb of chloride of sodium stirred until dissolved not

the ferrocyanide of potassium is a salt which it is one difficult to obtain at the drug warehouses may be made from the ferrocyanide of K<sub>2</sub> This salt is not decomposed by light and paper saturated with it will retain its virtue keep moist for any length of time if placed in a closed jar prevent evaporation after it can be used immediately after immersion in the solution but clearer marks will be obtained after the excess of fluid has been evaporated and the paper is just moist to the touch - formula No 3 with Logwood chl 5 - etc

This solution has a delicacy as great if not greater than the iodide of potassium paper and gives permanent marks but has the drawback that after a short exposure that Logwood is decomposed and the paper nearly the same shade of color as the original marks formula 4 1 - water chl - a solution of cochineal freed from fat by digesting with ether

This formula is very delicate gives marks of a permanent

character but the marks do not show plainly as other formula owing to the deep color imparted to the strips by the coloring matter of the cochineal formulas, 5. pyrogallie. v. formula - 6 Sulphat of pot describe formula. 7. hydrosulphuric acid describe, 8. hydrosulphat. Ammonia describe - these formulas are the results of an immense amount of experimentation. The author laboring under the load of a very small knowledge of chemistry at the outset. The principle of chemical recording is this if a current be passed through an iron wire on paper setting upon paper moistened with water see fig



which formed of two atoms of  $H_2$  hydrogen and one of oxygen the water is decomposed the hydrogen on the plate C and the oxygen at the point where the wire X, comes in contact with the paper - this oxygen being in what is called nascent state of oxygen the iron forming the first oxide or protoxide of iron this oxide is white and will be imperceptible, if the paper is exposed to the air for a very short period of time the first oxide or protoxide absorbs more oxygen from the air when its nature is changed and a new and entirely distinct compound is formed called the sesquioxide or peroxide according to the length of time the paper is exposed to the air the protoxide is always formed at the first instant the current is passed through the paper <sup>note</sup> bodies which have just been set free from one combination have more powerful affinities than when already free

Providing the metal used is alloyable - if now instead of using water the ferrocyanide of potassium forms a part of the solution - which is recommended in nearly all standard works on telegraphing the iron protosulphate, would not combine with the ferrocyanide of potassium to form Prussian blue until the protosulphate has been changed into a higher oxide (15) iron with in combination with iron there 1 atom of oxygen as this takes a small period of time it follows that if the wave follows each other very rapidly that there will be no time for the higher oxidation to take place - hence at the propitious moment when the oxide is in a state to most powerfully enter into another combination it finds no substance with which it can combine until it has been free for some time then it enters into combination to form Prussian blue but very slowly and the results are inferior another effect takes place which is that the protosulphate is formed upon the surface of the iron relay and where it finds no salt to form a combination so as to free it forms the gas by slight pressure the particles of the oxide cling with intensity to the iron & are spread over the surface of the paper to a greater extent than if it could combine at the instant it was formed two springs of paper one moistened with iodide of potassium the other with ferrocyanide of pot and most a placed side by side record at a given speed the result - - - - -

Trans. - - - - -

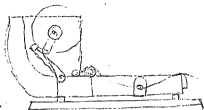
it will then be seen that the ferrocyanide of potassium does not combined with the first oxide formed by electro-decomposition here it has little or no delicacy and is worse than useless either in experimentation



or telegraphing it is obvious from the above that some chemical which will enter with avidity in combination with the oxide of the metal which combination has a conspicuous coloration. ~~then~~ auric Chloride of Sodium is Logwood ferrioxanide of Potassium cochineal Pyrogallin Etc are such salts in the case of auric chloride of Sodium the gold combines with Etc to form the purple of Cassius with ferrioxanide of Potassium it combines with the protoxide formed by decomposition of the water to form Turnbull's blue Sulphur of it the hydrosulphur combines with the protoxide of iron from the sulphuric acid of iron all of which are insoluble in water and cold dilute acids were they soluble the marks would not be permanent - the peculiar action of the water principle of Logwood and Cochineal with the protoxide is not so clear. The author has noticed several compound solutions of his experiments the base of which were organic matter which was more sensitive to the electric current when when these the most delicate moron galvanic but the marks were the most fugitive character for these experiments will probably give a permanency to one or more of these solutions the value of which in automatic telegraph cannot be overestimated - in all solutions where the styptic takes part in the chemical combination considerable pressure of the styptic must be given on the paper so as to deposit the new compounds upon the paper and prevent mechanical dragging

No 86

out of the signal thereby producing attenuation of the marks independent of the same attenuation produced by the static discharge when the stylus does not enter into combination for instance a platinum and iodide of potassium light Yttrium can be used without mechanical attenuation chloride of barium or common salt is added to all these solutions to reduce the resistance of the moist paper so as to augment the amount of decomposition the paper which is to be used is not a matter of indifference fine thick well washed bellows cotton paper will give infinitely sharper and more perfect signals than ordinary paper fiber — Shows a very convenient instrument for wetting the paper



it is receiving etc etc

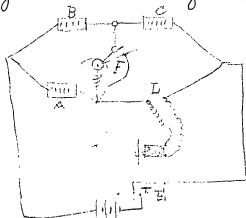
fig show reel



Rough and miled heads prevent slack etc hand rubs the self induction of Electro Magnets the self induction of Electro magnets is one of the greatest drawbacks to perfect

No 37.

instrumentation in system in which they are employed the instruments what is used in the following Experiment was the chemical recorder with two recording stylus resting on the paper which moved uniformly by clockwork controlled by a very accurate governor arranged in the bridge wire of a bridge in one of the branch of which is placed the magnet to be tested figure shows the arrangement=



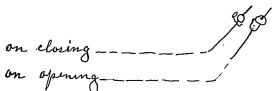
any device which is susceptible of generating induced currents or secondary currents due to chemical action may be inserted in the branch D

The Branch A and B being Equal and the resistance of C, being made Equal to the resistance of the magnet to be tested upon closing the Key F, and keeping it permanently closed no current passes through the bridge wire F containing the chemical recording instrument but the current from the battery passes the branch C, and D and A and B.

No 38

That portion which passes through the branch, D, charges the Electromagnet. If now while the magnet is charged the Key E be raised the current is broken and the induction discharge from the Electromagnet flows within the circuit formed by the wires C, D, and F. This current will decompose the chemical solution and record itself permanently on one of the iron points, if now the Key, E, is closed and opposing induction discharge is thrown within the circuit formed by C, D, and F, and is recorded on the other pen.

Thus



without an ordinary relay of the Tillotson pattern used extensively on the American Railroad telegraphs the record was made thus by successive opening and closing of the Key F. armature  $\frac{1}{4}$  inch from cone

Due to induction - closing — — —

Due to induction - opening — — —

armature in contact with cone

Due to induction closing

" " " opening

The following diagram will perhaps explain the action better



No 89

The resistance of the relay was 134 Ohms total length of Cores, 5 inches diameter cores  $\frac{9}{16}$  - diameter of pool  $\frac{1}{2}$  - (See if correct)

Second Experiment, ordinary relay Phelps Patent used Extensively by the W. U. Telegraph Co - Resistance 134 Ohms diam core  $\frac{1}{4}$  - in coils - - - total length of cores 3 inches armature one quarter inch away

Due to induction closed - - - -

" " " open - - - -

with armature in contact due to induct closing - - - -

with a special relay having 134 Ohms Resistance with same dimensions as Tillatson except length of Cores which were but 2  $\frac{1}{2}$  inches armature  $\frac{1}{4}$  away to induction closed - - - -

open - - - -

armature in contact induction closing - - - -

with a relay having but one of pool arranged as shown in fig with 134 Ohms R 1 inch long core  $\frac{1}{4}$  with armature in contact the induction was so short duration and weak that a mark was scarcely perceptible on the most sensitive chemical

his next experiment was with a magnet of greater length the total length of core 10 inches diameter  $\frac{9}{16}$  - R 134 no armature - induction closing - - - -

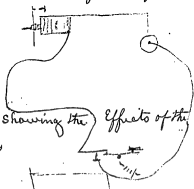
open - - - -

with Keppen in contact induction closing - - - -

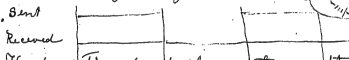
open - - - -

No 40

Experiments were tried with magnets having a total length of several feet from which induced current flowed within the bridge circuit several seconds after the battery had been disconnected. A comparison of the different records made show that the induction action increases at the square of the length of the magnet and apparently at the square of the distance of the armature from the face of the cores. These two laws will account for nearly every defect in electromagnet instrumentation. The number of convolutions increases the amount of induction as well as the mass of iron but if the proportionate increase of convolutions and increase of iron is made on every magnet the recorded magnets still show the ~~truth~~ law of the squares — as sent through as if the Tillatson relay as shown in fig —



The record will be thus showing the effects of the induction in modulating the signals



The induction due to closing the circuit does not show to the same extent as that due to opening but this can be explained that in this case the whole power of the current is used to

No 41

over come the change, whereas in the bridge there were  $\Delta$  gives it a route free from induction influence hence the offering electrometer force of the inductance current balances it in the wire  $\Delta$  hence no interference with the induction takes place in the bridge this diagram may explain the dashes better



if the armature is adjusted away from the face of the magnet the record will be this

Sent

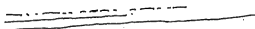
Recd



if a very long magnet is inserted in place of the Tetrahedron the record would be this Sent

with ordinary more writing at 10 words per minute the record will be Sent

at



when a magnet having a cone the total length of which is less than 1 inch attenuation of the mark cannot be perceived

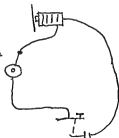
- See about juggling in several and increasing the battery in proportion as increased R. See how will effect it if the relay is arranged as shown in the following diagram no effect from induction except on closing is experienced

No 42

as there is no current for the induction to discharge in when the Key is opened and the record will be

Sent —————

Received —————



It must be remembered that when the current is sent through an Electro Magnet the induced current generated is in a contrary direction to that current and in the same direction on opening



Notes -

Neutralizing Escape - show Kram  
Method in amn form -  
Show Smiths arrangement in good form  
Show 3 modifications of my Wt  
arrangement.

1 Say Bradley gal plate rubbed  
with cloth will electric the  
needle and cause it to  
stick to Metal. Acid may be  
discharged by lay the flat  
of the hand on it - ~~get good~~  
Get it out also separate at  
showing coils & needle. ~~add~~

Delayed Relay the bar being delayed by a  
small constant battery

11

MC - US - woodwork bullet chaper  
for Lachman Cut & discipline  
Lachman

Walkins Alarm -

Ann. District regular met  
" " Bugla Alarm

1 doz goods escapement  
2 or 3 good unions

Self starting request

Register Reprints by letter & Embossed  
paper --

Duplex - Having Sending receive his  
own writing back

My two ways Duplex Cut & discipline  
with Way Station

(2)

Description of my battery  
also results of experiments on  
prevention of diffusion if that  
not so then the reason blue  
kept down cause the action  
takes place right at Copper &  
Blue Vitrol used as fast as  
it tends to rise where  
~~the~~ in old way no action takes  
place in rising fluid but  
way down at hollow

Test that spring pulling with  
spulling against explain why

that induction be greater on  
lines whose poles dont make

(33)

good earth for in that case  
the distance from one wire  
to the other goes over the same  
material that it goes to  
ground hence if the pole  
be very dry & makes poor  
earth on closing conduction  
takes place across the  
air but quickly ceases  
owing to the polarization of  
the contact parts of the  
wire by the moisture of the  
wood. This would explain the  
great induction on the overhead  
wires running through dry desert.

one of the reasons why relay  
on a ground wire is not  
uniformly successful is  
because, of return currents  
from other wires which when  
exactly equal make the relay open  
when distant man closes  
& when not equal reduce  
the effective working strength  
of the distant current  
according to the variation of  
the return leakage, owing  
to the nearness of the feeding  
batteries, this cause of  
bad working is Duplex.  
balancing the leakage  
is done by the plan now used but not a <sup>CS</sup> <sub>100</sub>

I was told at Greenwich  
that Earth Cords in Atlantic  
sometimes potential 500,000 Volts  
all charges from N to P  
sometimes in less than  $\frac{1}{2}$   
min.

Sparks due to a great number  
of magnets in circuit may  
be nearly annihilated by  
putting sq. foot tin foil each  
etc etc

---

63

7

placing thick paper paper -  
between armature & screw  
magnet up close so as  
to get core near armature &  
use powerful spring of paper  
get very ~~quick~~ feeble signals.

→ pointed platinum points  
make better contact & longer  
than flat → because  
in the case the oxide has  
a clearance but with flat  
points it has not -

Compressed platinum hydrous  
or very hard drawn gives  
less spark best for use

[7]

prevalent Idea that sound  
points change ckt better than  
relay etc gold leaf expt  
etc - show loss of part of  
signal by changing time

Why spring joints should  
be used about rebound  
of all keys - proved by  
the quick fall of current  
generating + break in  
induction of magnet in  
bridge showing

when held full power  
with open light

CS



Bad Connection in revolving shafts.

Vibrating points best

Compressed air coupler -

Secondary Batteries

Indication of Condenser Cables

Leiden jar secondary charged action,

At Cable

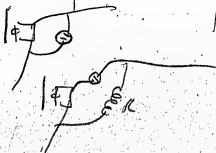


[9]

Say chemical recorder splendid  
instrument for investigation  
Comparison -

get highest obtainable speed  
through 1000 mile Res.  
with small Battery 136. Cps

Primary Battery shunting  
a relay



Thus

Describe effect show  
Constant Current

+

[103]

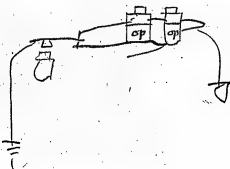
Automatic plan of putting number  
way off on wire & get signal  
from main relay.

Work up system of Register repeating  
so as to combine number of Branch  
offices with main office message  
rec'd Embossed & transmitted  
over main wire from Embossed  
strip - say peculiar strong paper  
used & peculiar high embossing

say old G & S Relays although only  
3/4 long retarded speed wave  
another short <sup>starting</sup> Relay allows of near  
double sp no waves be used  
600 used by Goddard and Stock

6113

Effect of polarized yet not



~~Proving a magnet~~  
 see if in movement prevents  
 of acting by vibrating p &  
 reverse coils double in Elets  
 magnet shown

[103]

Resistors Carb off. Kanran  
stone + plumbago graphite  
also on glass hard rubber  
etc =

Mention where a wire may  
get grounded through local  
connections with battery in  
floor damp place - offer  
wire for local running in  
damp walls over gas  
pipes etc -

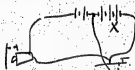
saw  
magnite been used at  
Louisville having a total  
length 11 inches worked bad  
on dry days & not so wet days [13]

17  
 Second of battery action on  
~~massive~~ ~~was~~ land wire

Now working with a  
 heavy battery through  
 a weaker opposing  
 battery give weak current  
 on closing - p & a test  
 see 27

against

is confirmed - This  
 little mark



July 5th 1874

Closing key Relay closes - opening K. Relay opens & will again close. <sup>after a time depending on the amount of poles of X battery</sup> = don't think. Should do this

18,

Compensating

Defect of reverse Current  
when strong enough to  
fully clear the wire &  
give an excess -

My Relay Worked by  
Disrupting the polarized  
& wkg from the discharge  
of the magnet - also this  
~~Edison~~

Why a polarized tongue  
should lay horizontal  
instead of perpendicular

[15]

19 1/2

Woods Bultin  
Aultin Bultin  
Hicks old  
Hicks no 2  
Hix latest  
Bunnell  
Haskins,  
Milliken

dots & dashes.  
Marks can be burned in <sup>paper</sup> ~~plate~~  
at the rate of — per min.  
by using ~~an~~ platinum wire  
& keeping hot by battery.  
(Aron) Request may be used for  
perfuming paper

[16]



19

Next to platinum for contact comes  
nickel - in most instances it  
is as good as platinum & very  
much cheaper. It is used for  
Contact roller in Automatic  
perforated paper transmission  
and gives good contacts at  
3000 words per minute.  
or 60,000 c.w.u.

The discharge from the magnet  
in a Wheatstone receiving unit  
interferes with the speed of how  
chemical records,

[173]

20

The reason why the spark is so much greater in a local circuit with a Grove or Carbon battery than with a Calland. of the same strength is owing to the greater resistance of the latter - by short-circuiting a main telegraph battery composed of Grove or Carbon batteries we obtained a dazzling electric light but if 20 shms. or even less be inserted as a part of the short circuit, were the spark is only just perceptible - This extra resistance is inherent in the Daniel, -

~~For many instances~~ hence for local circuits a different apparatus where a great number of Calland

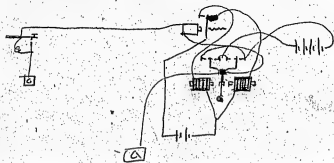
E16.3

are made the <sup>21</sup>Calland should be used -

Movement - Page had it think used only  
RF signal



Method of ~~reversing~~ getting reversal  
on a line at one station where from  
the <sup>on</sup> battery at the distant station



E193

22

Page - p 19 -

To make ordinary Resinoid -

1 gal Sul A. 3 gal water -

in separate vessel disin

3 lbs Bichrom in 2 gal boiling

+ add to other stirring thoroughly

The proportion of potash

sometimes made  $\frac{1}{2}$  greater

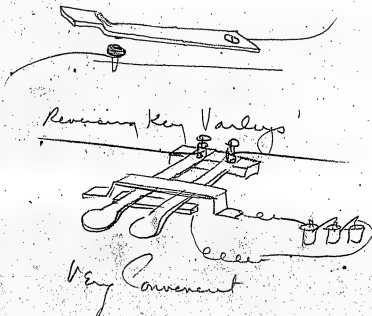
to make a more granulating

fluid add 1 gallon water to 1 gal Sul A

to 1 gallon Sul A ~~1 gal~~

[20]

Simpli Key



Key weak req current sometimes the  
permanent Magnetism is equal to  
req current in that case the relay  
opens when Key closed

[a1]

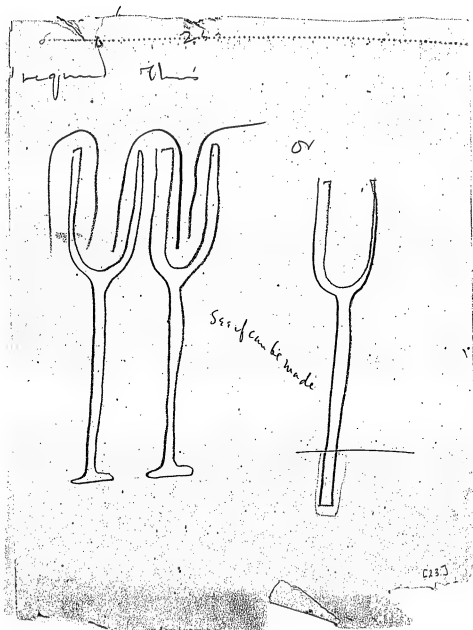
24

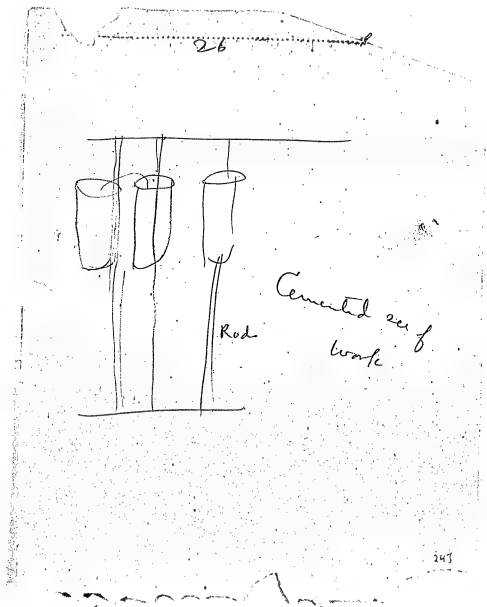
Revised Current translators  
Effect open ckt repeater,  
 Several RR signals get  
discipline from Apang  
 Test battery



When both modulation

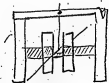
(22)





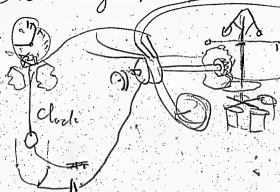


Simple Galvanic



get good Cut of Ammonia Combustion  
Helps Your Separation.

Chronograph for chemical



[25]

Ducant self adjusting Relay  
 Siemens Patented Relay Amalgam

Thomson Mirror

good ~~reversing~~ Key

Self Closing Keys

Van Hovenburg's tension

Van Hovenburg's Rattle sounder  
 Rattler

Switchboard all kinds

Mention when testing Long magnets

don't shake floor to insure

Electromotive battery get bad

Results don't last magnet  
 written several feet from end

11  
mention<sup>as</sup> proposed by Little  
weekly signal e. a. to not  
show static - say how work  
but this already done by  
Bunnell's with no big little  
result - Same person  
adds Indian but the  
decrease speed instead of  
augmenting it. Experiment  
made between W & T gave  
a highest speed ~~too~~ 90 w  
per min on most sensitive  
lamp paper - that was a readable  
good rain product ~~the~~ result

[27]

30.  
in long currents how a half  
current should be sent for  
dashers  
How first part of letter should  
be longest

0000

How speed increased by using  
European alphabet & elapse  
spacing

Show results on paper when  
it is attempted to work.

19th Century Chemical Duplex

Show my Automatic perforated  
paper Duplex

[48]

My perforator Old, new -  
 modification by Peckskillman  
 Roman perforator

old paper feed.

3 Key perforator,

Combination to produce morse  
 characters etc Roman

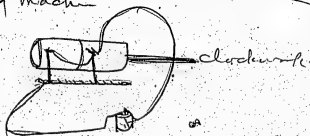
Embossing

45 lever printer

Chemical printing machine

Melrose

Copying Machine



Thick ink smudging

593

32  
artificial Cable -

artificial Cable with magnet

artificial " with secondary battery

gave experiment & recorded its  
results with all -

~~Try winding large frame~~

Bradley's spools -

test of strength compared  
with silk same Resistance

Get his table,

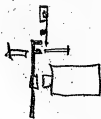
[10]

Duplex streams may have  
way station receive  
by using a very short  
relay shunted -

+ the current from the  
station sending is  
double strength of  
the other current

Duplex would be best  
when relays repeat  
arrange out for that

37  
a Relay is best with  
spring point chies



gutta percha that Varnish  
to Coat arms of groove &  
oth zinc in place  
of asphaltum which  
becomes spongy try it  
Asphaltum recommended  
by Pope

[32]



35-

oil on Calland Battery X  
 nuisance - Wooden Cover  
 prevents evaporation

Effectively - oil generally used  
 Cotton Seed - is soon oxidized

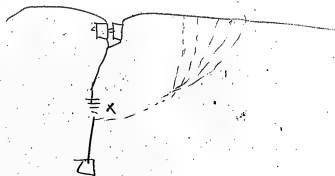
to make Carbon Battery  
 last long while -  
 porous plat  $\frac{1}{2}$  inch  
 thick - try --



031

Whether there are several magnets in the same circuit & though ~~not~~ whose ~~armatures~~ armatures are vibrated rapidly the stopping of any one of these ~~armatures~~ is liable to alter the ~~adjustment~~ of the rise by reason of the increased or decreased strength of the induction currents generated by that magnet for instance several printing instruments whose type wheels were rotated by magnetism and adjusted properly were thrown out of adjustment by holding down the armature of an extra magnet in the circuit.

[34]



Resistance of leakage being water  
 is subject to polarization is decreased  
 by putting on battery X hence  
 when everything is equated for  
 the taking off of X will allow  
 not take off a electromotive  
 force off of the water leakage

X ~~has~~ ~~reduced~~ its resistance  
so that when the distant  
current comes through not  
so much will pass via  
water leakage to Earth as  
through metal leakage  
but when X ~~it~~ ~~breaks~~  
down the resistance of  
the water derivations X  
although <sup>X</sup>equated more  
of the distant current  
will pass through leakage  
owing to the peculiar  
Effect of X in reducing R of water.

One advantage of  
a ~~more~~ permanent current  
is that the leakage or  
cross fire is generally  
all in <sup>one</sup> direction whereas  
on the English lines  
we receive currents in  
both directions so that  
we have a current between  
N<sup>o</sup> 1 & 30 elements & on  
the English lines between  
N<sup>o</sup> 1 between 310 Positive & 30  
negative or a ~~same of 60~~  
disturbing effect of 60 elements.

will always be a drawback  
to the fast system,

Excessive underground work  
as well as the close proximity  
of one wire to another & the  
use of earth wires to prevent  
cross currents all of  
which are in use in  
England render their  
system far inferior to the  
American - say about  
static charge in

Q383

Notes:

(1)

Theoreticalizing Escape Show Wrenn method in a new form  
Show Smith's arrangements in good form Show 3 modifications of my W.A. Arrangement

Buy Baudley's gal-plating method with cloth and electrolyte the needle and cause it to stick to metal circular may be discharged by say the flat of the hand on it. Show good cut also separate cut showing coils & needle. ~~W.A.~~

Polarized Relays the bar being polarized by a small constant battery

Has Smack's Clockwork battery charger for Leclanche cut & description.

Hall's Alarm

U.M. Distinct regular cut

" " Burglar Alarm

1. Doz goods arrangements. 2 or 3 good unions def. starting register

No. 2.  
Notes

Register Repetitor by Lever & Embossed paper

Amplex having landing across his own writing back

May two ways Amplex Cut & description with my station

Description & Cut my battery also result of experiments on prevention of diffusion if that's not so then the reason line kept down cause the action takes place right at copper & Blue Vitriol used as fast as it tends to rise when in old way no action takes place on rising fluid but way down at bottom.

Test that spring pulling with & pulling against. Explain why

What induction be greater on lines whose poles don't make good Earth for in that low the distance from one wire to the other goes over the same materials that it goes to ground. hence if the pole be very dry and makes poor Earth on closing conduction takes place across the arms but quickly ceases owing to the polarization of the contact parts of the wire by the resistance of the wood. this would explain the great induction on the Overland wires running through dry desert.



# Notes at A. 3.

One of the reasons why receiving no ground wire is not uniformly successful is because of return currents from other wires which when exactly equal makes the relay open when distant wire closes & when not equal reduces the effective working strength of the distant current.

Secondly to the induction of the return leakage owing to the rearmers of the feeding battery, the cause of bad working in duplex. balance the leakage is done by the plain wire used but not in duplex.

I was told at Greenwich that East currents on Atlantic Cable sometimes polarize 50 Daniell cells change from A to B. sometimes in less than 1/2 minute.

Spark due to a great number of magnets in circuit may be nearly annihilated by passing 1/2 foot in foil each etc etc.

placing thick pieces of paper between commutator & reversing magnet up close so as to get core near action and use powerful spring of paper get very feeble signals  
 → pointed platinum points makes better contact & longer than flat. —

Note - *Sept 4*

because in this case the Oxide has a clearance  
but with flat points it has not.

Compressed platinum Hydrate or very hard drawn  
gives less spark best for Inst. present. Idea that  
smaller points close set better than relay etc  
gold leaf Experiment etc - Shows loss of part of signal  
by chattering lines

Why spring points should be used about rebound  
of all keys - proved by the quick fall of current  
generation & break in induction of magnet  
in bridge showing

When held full power  
with spring left

The pressure of contact points in case of speed must  
have increased pressure - Copper better than platinum  
- Oil good at first Oxidized by spark dissolved in  
excess the Oxide (black) which drops quickly on  
stoppage few minutes & hardens in places.

No 5  
Notes

Show chemical records of a break wheel at same pressure at different speeds - See what increase must be given for increase of speed to get good record but correction in rotating shafts -

Vibrating points best

Compressed air sounder. Secondary battery  
Induction of condenser cable. Leyden jar secondary  
chemical action

Atlantic cable



See chemical recorder Sphenoidal instrument for investigation by Comparison -

Sending battery shunting a relay

& this

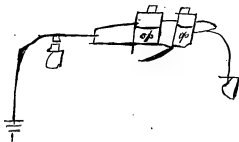


Notes No 6<sup>th</sup>

Describe effect show course of currents.  
Anticipated plan of putting number of way offices  
on wire & get signal from main relay.

Work up system of register repeating - so as to combine  
number of Branch Office with main office message  
rec'd Embossed & transmitted over main wires from  
embossed strips - say peculiar strong paper used &  
peculiar high embossing.

Say old G.S. Relays although only  $3\frac{1}{4}$  long extended  
speed wires. With short slotting relays allows of  
nearly double the number of wires be used. too used  
by fold & stock effect of polarized. yet not.



See if in movement prevention of acting by vibrating  
P & reversed coils double in Electro magnet  
shown.

Note

Resistance Coils of Kansas stone & plumbago, graphite  
also on glass hard rubber etc =

Mention where a wire may get grounded through  
local connections with battery on floor lamps, places  
office wire for local running in damp walls over  
your pipes etc =

low magnet used at Riverside having a total length  
11 inches worked bad one day day nothing of worth

secondary battery acting on land wire —

How working with a heavy battery through a weaker  
opposing battery gives weaker current wire closing  
P & A test Dec 27<sup>th</sup>

Against — — — —

yes confirmed — this



July 5<sup>th</sup> 1874

Notes

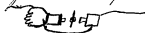
No 8

Closing Key relay close opening K relay opens & will again close. after a time depending on the amount of polarization of X battery - don't think Daniels do this.

Compensating

Effects of reverse currents when strong enough to fully clean the wire & give an excess -

My Relay worked by depleting the polarized & working from the discharge of the magnet - also thus



Why a polarized tongue should lay horizontal instead of perpendicular.

Hoods Button  
Authors Button  
Hicks Old  
Hicks No 2  
Hicks Latest  
Russell  
Haskins  
Milliken

Notes

9<sup>th</sup>

dots & dashes  
marks can be made in paper at the rate of  
— words per minute by using a station wire  
& keeping hot by battery (Horns) regulated may be used  
for perforating paper.

Nickel to platinum for contact comes nickel in most  
instances it is as good as platinum and very much  
cheaper. It is used for contact roller in perforated  
paper transmissions and give good contact at 3000  
words per minute or 6000 waves.

The discharge from the magnet in a wheel tone receiving  
circuit interfere with the speed, slow chemical records

The reason why the spark is so much greater on a local  
circuit with a grove or carbon battery than with a cell and  
of the same strength, is owing to the greater internal distance  
of the latter - by short circuiting a main telegraph battery  
composed of grove or carbon batteries we obtain a dazzling  
electric light but if 20 ohms or even less be inserted  
as a part of the short circuit wire the spark is  
only just perceptible - this extra resistance is inherent in  
the contacts

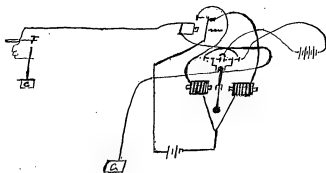
Notes 1.0<sup>th</sup>

Hint for local circuits in different apparatus  
 When a great number of contacts are made the calland  
 should be used -

Movements - Pope had it. Stroke used on his P.R. sign



Method of getting reversal on a line at one station  
 when from one battery at the distant station.



Pope page 19 =

To make Ordinary Red fluid -

1 Gal Sulphuric Acid - 3 Gal water - in separate vessels  
 dissolve 5 lbs Bichromate of Potash in 2 Gal boiling &  
 add to other. Stirring thoroughly the preparation of paste

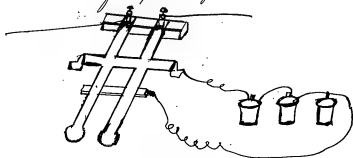


11  
 Sometimes made 1/5 greater to make a more  
 quantifying fluid add 1 Gallon Water Saturated  
 Solution of Bichromate - to 1 Gallon Sulphuric Acid

Sample Key



Reversing Key Varleys



Very convenient-

Very weak receiving current sometimes the permanent  
 magnetism is equal to the current in that case  
 that relay opens when key closed

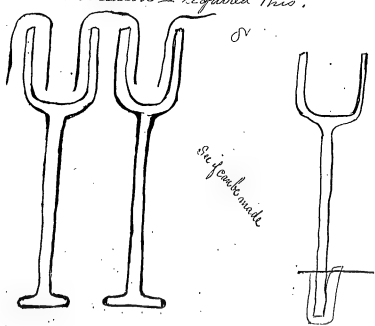
(12)

Reversed Current translators efforts open circuit  
repeater. Several P.P. signals get discription from pump.

Test Patterns.



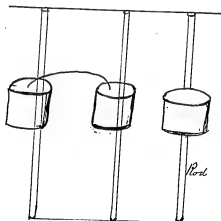
When better insulation is required this.



or

See if cable made

73

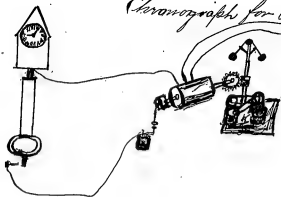


*Simple Galvanometer*



*Get good cut of American Combination with Multi-former  
Separate.*

*Chronograph for Chemical Unit*



Davenport Self Acting Relays

Simmons Biological relay American Style

Thomson Mirror

good receiving key

Self closing keys

Van Housburgs unicon

Van Housburgs Rattler Sounder

Switchboards all kinds

Mention when testing long magnets - don't shake floor  
to increase Electromotive force battery - get bad results don't  
test magnet within several feet of needle.

Mention as proposed by Little - weaker signals so as  
to not show static - say how works - but this already  
done by Bonnell; with very little result - same person  
adds condenser but this decreases speed instead of  
augmenting it. Experiments made between Washington  
and New York. gave as highest speed 90 words per minute  
on most sensitive iron paper that was readable  
good wave produces this result. In long circuits  
how a half current should be sent for dashes.  
How first part of letter should be longest

0000

How speed increased by using European alphabet  
& close spacing.

Show results on paper when it is attempted to work  
Jentit chemical Duplex. Showing Automatic  
perforated paper duplex.

My perforated old (new)  
Modification by Peckskill man  
Roman perforator

Old paper feeder

I Key perforator

Combinations to produce Morse character Eli Roman

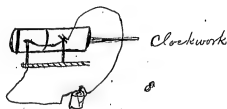
Embossing

45 lever printer

Chemical printing machine

Millwaukee

Copying Machine



Thick ink Draftings

P/6 <sup>the</sup>

Artificial Cable —  
Artificial Cable with magnet  
Artificial Cable with Secondary batteries.  
give Experiments & recorded results with all

Braidley's Spools —  
Tests of strength comparison with silk. Same  
resistance —.

Get his table

Duplex Stearns may have way Stations  
receive by using a very short relay shunted  
& the current from the Station sending is double  
strength of the other current.

Duplex would be best when relays repeat  
Arrange cut for that.

A. Relay is best with Spring points thus.



127

Guttapercha thick Varnish to coat arms of grove & other yines in place of asphaltum which becomes spongy try it asphaltum recommended by Pope.

Oil on Calland balls nuisance - Wooden Cover prevents Evaporation - Effectually - Oil generally used Cotton Seed - is soon Oxidized to make Carbon battery last long while porous pot  $\frac{1}{2}$  inch thick -  
Sry.

Where there are several magnets in the same circuit whose armatures are vibrated rapidly the stoppage of any one of these armatures is liable to alter adjustment of the rest by reversing of the increased or decreased strength of the induction currents generated by that magnet, for instance several printing instruments whose type wheels were rotated by magnetism only and adjusted properly these were thrown out of adjustment by holding down the armature of an Extra magnet in their circuit



Resistance of leakage being water & subject to polarization is decreased by putting on battery X hence when everything is Equated for the taking off of X will take off a electromotor force of the water leakage.

Hence reducing the Effect.

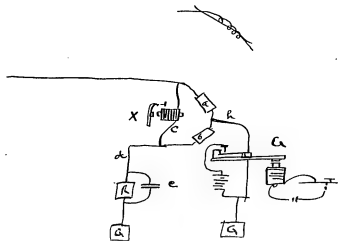
So that when the distant current comes through not so much will pass via water leakage to Earth as through metal leakage but when X is on it breaks down the resistance of water leakage & although Equated more of the distant current will pass through leakage owing to the effect of X in reducing R of water.

One Advantage of American permanent current is that the leakage or cross flow is generally all in one direction where as the English lines. We receive currents in both directions so that we have a current between Nil & 30 Elements & on the English lines between 30 positive & 30 negative or a disturbing effect of 60 Elements where as present insulated will always be a draw back to fast systems.

Excessive underground work as well as the close proximity of one wire to another & the use of Earth wires to prevent cross currents all of which are in use in England render their system far inferior to the American. Say about static charge increased



If the receiving instrument be a mirror galvanometer the induced currents generated are very weak and will scarcely distinguish its working but if the ordinary Morse relay is used the induced current will produce a modulation of the signal in the shunts the cones of the receiving magnet are the lines the ~~disturbance~~ <sup>induced current</sup> figure 21 shows this method,



A B are adjustable resistance coils, which independent of the other Connections form a shunt around the receiving instrument.

d is the artificial line, R the rheostat for make the resistance Equal to the line and  $c$  the Condenser to produce a static charge upon the artificial line Equal to balance the static charge upon the regular line, & h is the battery wire placed between at the central point of resistance of the shunt. G is the usual device for connecting & disconnecting the battery. If the rheostat R is adjusted so that it shall have the same resistance as the line wire, and the Condenser  $c$  has the same

Electrostatic Capacity as the  
 wire. Then there are two wires  
 one on one side of the instrument  
 and one on the other side of  
 the instrument both having  
 the same resistance & Electrostatic  
 Capacity. If the rheostat  
 a & b are equal in resistance  
 and the battery is connected  
 to the bridge by the upward  
 movement of the sounder  
 lever. it follows that  
 the current will divide equally  
 upon the regular & half-sized  
 wire. and none will pass  
 down the bridge wire c  
 containing the receiving instrument  
 as the resistance on both sides  
 are equal and there is no  
 cause for a difference of  
 potential. If no condenser  
 was connected to the  
 artificial wire that  
 portion of the current due

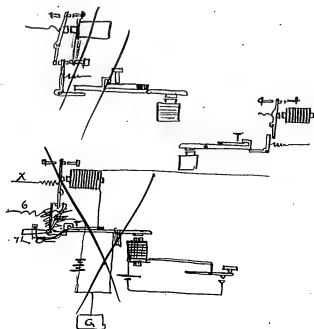
to the state change of the line  
would pass through the  
instrument, 0

The resistance of the artificial  
line can be reduced to  
less than the resistance of  
the line and the difference  
compensated for by increasing  
the resistance of the ~~new~~  
Rheostat B, but the ~~effect~~  
the decrease of resistance  
between the <sup>one</sup> armature of the  
Condenser & the other of course  
decreases the electrostatic  
Capacity of the ~~line~~ artificial  
line d. When signals are  
received from the distant station mostly  
one half of the current passes  
through the coil a to the ground  
via h the other portion through  
the relay thence through b  
to the ground and a small  
portion through d to the ground.

When the signal ceases  
 the induced current from  
 the magnet circulates within  
 the circuit formed by  
 a, b, c thus preventing the  
 instantaneous change and  
 discharge of the relay and  
 modulating the signals in  
 the exact proportion as the  
 length of the compressed  
 magnet and number of the  
 convolutions are increased  
 and the resistance of the  
 derived circuit. This effect  
 is partially compensated for  
 by the slight static reduction  
 changes which are generated  
 by the small quantity of  
 current which passes to the  
 ground through d.

Mr. Stearns is the inventor of another  
 very ingenious modification which

is shown in figure — .



The ~~but~~ effect of the outgoing current in this method is compensated for by mechanical means. a is a lever b, a spiral a retractile spring having a tension equal to the effect extra magnetism ~~in the~~

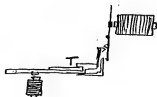
relay due to the outgoing Battery.  
 This lever comes in contact &  
 rests on the Extension of the relay  
 lever when the Sounder lever is  
 raised and ~~the 0 battery~~  
 instant the battery <sup>contact</sup> points  
 separate and the battery B'  
 is thrown on the line.

The advantages of this method  
 is that if the Equation be not  
 perfect no extra signal  
 will be thrown in as in  
 the Double Coil duplex  
 but the effort will be to  
 reg. <sup>upon the spring</sup> ~~change the adjustment~~  
 of  $\gamma$  to be adjusted frequently.  
 Mr Stearns describes no  
 method of counteracting  
 the Detraction Charge.

This charge may be counteracted  
 mechanically as shown

29.

in fig.

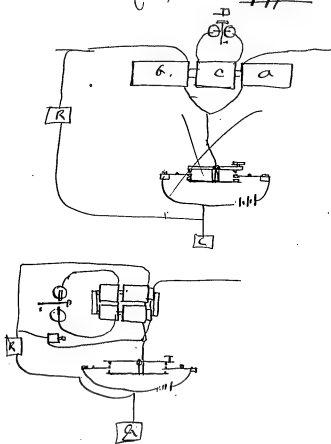


The following ~~systems~~ methods were devised by the author and are <sup>for</sup> ~~an~~ <sup>an</sup> illustrations of the enormous number of combinations which it is possible <sup>to make</sup> with telegraphic apparatus. A portion of them have serious defects, while others are as nearly perfect as it is possible at the present time while others will perhaps be found as <sup>are</sup> more perfect than the methods now in use.

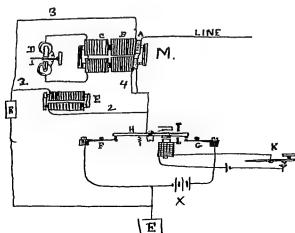
The first method which I shall now describe is worked entirely by induction, which requires less perfection of balance



and has a greater working  
margin besides allowing the use  
of apparatus which is nearly  
self adjusting. This method  
is shown in figure ~~###~~



29.



M is a long Electromagnet upon which are wound the coils A. B. in opposite directions to another, The Coil A is in the main line circuit and the Coil B in the artificial line R is the resistance Coil adjusted so that its resistance including the coil B is equal to the resistance of the line, C is an Extra Coil not in connection with either Circuit. The two free ends of

2. *Quincy* (1878)



m.p. is the main water pipe; we will suppose that this water pipe circuit extended from Wall St to Harlem, and that A and B were ~~down~~ Engines & reservoirs by which a quantity of water of any desired amount might be made to circulate in the direction ~~th~~ as indicated by the arrows.

U and X are two water wheels provided with levers, which open & close <sup>between</sup> slides <sup>at</sup> fixed points

### 3 Duplex.

\*springs are secured to these levers to keep them against the proper point when no water passes,

The object of the secondary water pipe circuits SP 1, SP 2 will be explained <sup>explained</sup> ~~present~~ <sup>at</sup> ~~the~~ <sup>when</sup> we proceed a little further.

Now suppose that a stream of water was thrown into the main pipes by A, it would but half fill the water pipes and traverse it in the direction shown by the arrows. The action after passing stream of water would be to slightly move both the wheels and bring them ~~from~~ <sup>to</sup> one fixed point to the other, hence by alternation when the water is stopped the levers are drawn back by the

'subs springs; so far the message  
 signal has been received at  
 both the home and distant station.  
 It remains now to ~~inquire~~ <sup>ascertain</sup> how  
 the wheel at ~~the~~ X <sup>m</sup> is left to  
 respond to A, and the wheel W  
 prevented from doing so.  
 You will notice by referring to  
 the diagram that the water  
 circuit S.P.I. is so arranged upon  
 the opposite side of the wheel  
 that the stream of water which  
 is injected into S.P.I. from A. tends  
 to turn the wheel in a direction  
 just the opposite to that injected  
 into M.P. hence if the amount  
 and speed of the water in both  
 the main & secondary pipes are equal  
 it is obvious that the wheel W  
 will not move; and as long  
 as these eq. balances <sup>are</sup> obtained  
 any kind amount of water or the

3'

travelling at any speed.  
~~speed which it circulates in the~~  
~~two circuits~~ may be sent from A  
 into both circuits without moving  
 the wheel W. The distant  
 station the water ~~in~~ <sup>leaves</sup> the wheel  
 as none of it can circulate in the  
 Secondary Circuit ~~SP. 2~~ of that  
 station,

We will now suppose that a  
 stream of water from A is circulatory  
<sup>the</sup> on SP. 1 and ~~the~~ <sup>leaves</sup> main circuit.  
 & the wheel X is moved to the  
 left hand point, W remaining  
 unaffected ~~as above~~ <sup>shown</sup> as ~~before~~ before.  
 If now the apparatus at B is  
 so arranged that the water may  
 be injected into the main pipe  
 & secondary circuit in the same  
 direction as that injected by A.  
 the effect of the ~~extra~~ <sup>injected by main circuit on SP</sup> amount of water  
 on the wheel X is exactly balanced  
 by that which circulates in the circuit  
 SP. 2. ~~It does not prevent the wheel X from turning by the water sent from W~~  
 but ~~the excess of~~

4)

"We will suppose that ..." (7 pages; incomplete; Edison's hand).

6

the water <sup>is injected at 150 lbs MP</sup> ~~discharge~~ the balance which  
~~adjusts~~ <sup>at</sup> ~~on~~ <sup>between</sup> MP & S.P.I.  
 and the excess <sup>from</sup> ~~the~~ <sup>the</sup> lever over  
 to the left hand side.

It will be seen that it is not  
 necessary that the ~~two~~ <sup>in</sup> should  
 flow in opposite ~~directions~~ <sup>to</sup>  
 obtain these ~~messages~~ <sup>ial</sup>,  
 It is possible to ~~transmit~~ <sup>the water</sup>  
~~from B could be made~~

In the Electric Duplex the  
 secondary circuits are replaced by  
 the Rheostat <sup>resistance box</sup> in which are coils  
 of fine wire, so arranged ~~that~~  
~~that~~ <sup>that</sup> ~~any~~ <sup>such</sup> an amount  
 of fine wire may be inserted <sup>sufficient</sup> to  
 will retard or set up a resistance  
 to the passage of the current  
 equal to ~~that~~ <sup>that</sup> offered by the line,  
 The water wheel is replaced by  
 a relay having double coils  
 of wire so that the current  
 passing over both the line

and secondary current in the  
 same direction may pass through  
 the two coils of the relay in  
 opposite directions <sup>as with</sup>  
 the water <sup>in</sup> ~~the~~ <sup>the</sup> ~~case of~~ <sup>the</sup> wheel  
 the effect ~~is~~ <sup>is</sup> obtained  
 by allowing the <sup>beams</sup> of  
 water to <sup>run</sup> ~~run~~ <sup>in</sup> the  
 opposite side of <sup>the</sup> wheel,  
 The current of a battery passing  
 through one of the coils on the  
 relays tends <sup>to</sup> make one end  
 of the iron core take a north  
 magnetism while the other  
 iron core takes <sup>a</sup> south  
 magnetism. But the effect  
 of the current ~~causes~~ <sup>causes</sup> ~~passing~~  
 through the <sup>other</sup> coil is  
 just the opposite of this it  
 tends to make a north  
 magnetism in the same core  
 as the other current is  
 endeavoring to make a south  
 magnetism and as the two



Magnetics Cannot Exist on  
one Core none is formed  
hence the passage of the  
Current through the relay  
does not effect the  
Conditions on the line  
are equal to the  
line formerly isolated  
(to be isolated) now!

## 2. Duplex

The effects of the transmitting battery upon the receiving relay at the same terminal.

The second feature, is to preserve the continuity of the circuit and equality of resistances in the act of signalling.

Mr Stearns method is shown in figure.

A is the duplex relay for receiving the signals from the distant end. The iron cores of this relay are wound with two distinct wires insulated from each other,<sup>†</sup> and so connected that the current from the battery G passes through each wire in opposite directions. One wire <sup>or bobbin</sup> is placed in the main line circuit, while the other is placed in the artificial line circuit.

<sup>†</sup> Two bobbins are shown in the engraving to convey a clearer idea,

Invented by Ruhmkorff of Berlin in 1844 and adopted by Stearns.

### 3. Duplex

When the rheostat in the artificial line is adjusted to offer a resistance to the passage of the current, equal to that offered by the main line, then the passage of the current from the main battery G over both lines will produce no effect on the relay A, as the tendency of the current circulating within the main line bobbin is to produce say a north and south polarity in the soft iron core, while the current in the bobbin connected to the artificial line tends to reverse this action. Hence the cores will not become magnetized.

Should the resistance of one circuit be less than that of the other, more current will pass through one bobbin than the other and the cores will become magnetic to that extent, and attracting the armature.

The main battery is connected and disconnected from the two circuits by the lever H operated by a magnet placed in a local circuit ~~with~~. This circuit is opened and closed

#### 4 Duplex

by the Transmitting Key K.

The Lever H is connected to earth. A spring ~~is~~ a 10 which is connected both the main and artificial circuits is secured to the Lever H by a block of Vulcanite,

When the Lever is unattracted by the local magnet this spring is in contact with the bent end of H, completing the circuits to earth. If the is attracted by the local magnet. the spring a is is thrown away from the Lever by coming in contact with the point c. The continuity of the circuits is still complete, but the battery a is placed on both circuits,

Mr Stearns inserts a small resistance in the earth wire at R 10 to lessen the spark at the moment when the spring a comes in contact with the point c and before it is separated from the bent lever,

It will be observed that neither the continuity of the circuit is broken or the resistances materially changed in the act of signalling.

### 5 Duplex.

and as the current from the battery G when permanently connected to line produces no effect upon the relay A. it follows that if the current on the main line be increased over that circulating ~~on~~ in the artificial line by connecting the battery at the distant station the cores of the relay will be magnetized and attract its armature. The same action takes place when the battery G is disconnected. for then there is no current on the artificial line while the current from the distant station <sup>is free to</sup> magnetizes the cores of the relay

So far this arrangement answers for ~~short~~ aerial circuits of 100 miles or less, but on longer circuits, the phenomena of static induction tends to destroy the balance which must be maintained between the two currents passing through the coils of the relay A. To preserve the balance Mr Stearns attaches the condenser C

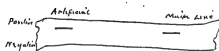
6 Duplex.

to the artificial line so as to obtain the  
as much static induction on the artificial  
line as is necessary to balance with the  
coils of the duplex relay the static induction  
of the <sup>main</sup> line, this method of attaching the  
condenser is somewhat defective as it only  
partially compensates for the static induction  
of the line nevertheless it is effective  
except on very long circuits of considerable  
electrostatic capacity.

The action of the static induction  
in this particular case is well  
illustrated by the chemical strips.

When the condenser C is disconnected  
from the artificial line of the battery  
A be put to in connection with the two  
circuits, the line wire being free from  
static induction a dash will record  
itself upon the chemical strip,  
as in fig.

## 7. Duplex



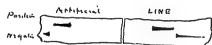
If the main line has considerable electrostatic capacity, the record will be as shown in fig



~~Static induction~~ the inductive current on closing is added to that of the battery. This of course destroys the balance <sup>and of the relay line time</sup> as the first part of the wave passing within the circuit of the artificial line is not augmented, upon disconnecting the battery, a static discharge is obtained which circulates in a direction opposite to the battery current, this wave which at first strong gradually ceases as shown on the slip. <sup>This produces another movement of the relay line & gives a false signal</sup> the longer the circuit the greater the length of time will the discharge take to fall to nothing. If the condenser is now added to the artificial line as shown in figure. The slip will

### 8 Duplex

present a different appearance, as in figure



The STEARNS manner of connecting the Condenser, does not produce the same effect as is produced upon the line, the difference is scarcely perceptible on short lines, and the compensation is practically sufficient but as explained before when the line is very long this method of compensation is defective,

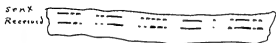
The line itself is a condenser or accumulator of static electricity which is distributed on along its entire length, and the charge upon each successive mile from the battery is less and less, ~~but the~~ and a certain time is consumed in charging it.

But the condenser being in direct contact with the battery (with the except of the relay resistance) is almost instantly charged. On disconnecting



9 Duplex

The battery, the condenser is almost constantly discharged owing to the low resistance connecting its two armatures, but it is not so with the line. The static charge must pass through a considerable resistance which of itself is an accumulator. Hence the current will flow on the line some time after the condenser has completely discharged itself, and this excess of current circulating in one line although not powerful enough in some cases to give a distinct movement to the relay lever is sufficient to mutilate the signals from the distant station as shown in fig



or when received by sounds will certain letters such as m q etc will be turned into L and n.

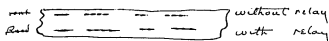
### 10 Duplex.

To more closely produce or imitate the conditions of the main line upon the artificial one, The condenser should be divided up into several parts and inserted between the several resistances composing the artificial line as shown in figure - This will distribute the static charge over the whole of the line and the length of time which it will take the charge to fall from maximum to zero will be equal to that of the line ~~dis~~, and a perfect balance of forces become possible,

It does not matter what condition obtains on the regular line so as it is imitated upon the artificial line ~~As~~ as the balance will be maintained for instance if an ordinary relay be inserted in the line wire. ~~the~~ it will generate an ~~discharge~~ inductive current which destroys the balance

## 11 Duplex.

But if a relay of the same character be inserted in the artificial lines the balances will be restored, although this does not compensate for the action which the discharge inductive current has on the receiving or relay independent of the balance on the distant relay produces; (6) (13)  
Distortion of signals as shown in Fig.



But this effect is not so bad as the destruction of the balances.

There exists another defect in this form of Duplex which is the self induction of the relays themselves. No self induction is produced upon the home relay by the outgoing current if it be well balanced. But with the current from the distant station it is different. To this current the double coil

## 12 Duplex.

acts as an induction coil ~~so to speak~~. The primary coil being in connection with the line while the secondary coil is the bobbin connected to the artificial line, when the distant battery is connected. The tendency of the line wire bobbin is to induce a wave into the artificial line coil of an ~~opposite~~ character which is augmented by the action of the condenser. These waves secondary currents reacting upon the relay tend to mutilate the signals. Several hundred of Mr Stearns Duplex are in use in this country. The author dispenses with the condenser and produces the same results with an electromagnet, fig" shows this arrangement.

### 13 Duplex.

M is an electromagnet with twice or thrice the resistance of one of the bobbins upon the relay. It is provided with an adjusting device by means of which the magnet may be made to approach or recede from a fixed armature c. If the magnet be adjusted ~~very near to the fixed armature~~ its self induction will be increased so that the faces of its cores will touch the fixed armature. the self induction of the magnet will be at its maximum and it will be decreased as the magnet recedes from it = ~~The equation of the static charge.~~  
waba Supposing the current of the battery to be placed permanently on the line the operation will be as follows upon disconnecting it. The line and magnet becomes charged now upon disconnecting the battery the static charge acting upon the main line bobbin tends to magnetize the cores of the relay as ~~has already~~ in the manner

14 Duplex

already described. But at the same time the induction current from the magnet  $m$  circulating within the closed circuit formed by the wires 3 4 and 5 and the bobbin tends to produce an opposite effect and the relay remains unaffected. If the main line gives a strong discharge then a discharge equal in strength may be generated in the electric magnet  $m$  by adjusting it nearer the fixed armature.

Upon closing the inductive current is added to that of the main battery current in that portion of the circuit formed by the bobbin & wire 5.

It is obvious that this device forms a much more convenient economical & effective arrangement for static Equations than the condenser

15 Duplex

When used in connection with submarine cable or land lines of great static Capacity the magnet  $\nearrow$  should be several times as long as the receiving magnet, otherwise the inductive current will cease before that of the line,

By this arrangement a local circuit operated by a second battery may be used which is not possible with the Condenser, as in figure — —

# 1 Duplex

The Duplex principle was invented by Dr  
Gentl. ~~The first practical Duplex was~~  
~~invented by Moses & Farmer of Boston~~  
~~in But the modern Duplex and~~  
~~the one which~~ But the first practical  
Duplex was invented by E. B. Mr  
Stearns of Boston.

Its Duplex instrumentation is one  
of considerable importance  
at the present time and a  
branch which illustrates the  
vast number of combinations  
which may be made to produce  
the same result and the  
Explanations it gives to several  
phenomena hitherto not well  
understood will be my excuse  
for the great <sup>lengthy</sup> number of  
pages devoted to this subject

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2 Duplex

The author has made an immense number of experiments in this branch of telegraphy and feels ~~that he is competent to~~ of which the following articles ~~are made~~ are abstracts from, and most of the devices described in the following pages are the result of experiment.

In that class of Duplex by which signals are sent in the opposite direction at the same time, the main feature is to neutralize all the effects which are produced by the action of the outgoing current upon the receiving instrument at the same station. The second feature is to preserve the continuity and equality of resistances in the act of signalling.\*

\* first invented by Farmer — & adopted by Shallen,

### 3 Duplex

The ~~Edison~~ method is shown in figure

A is the Duplex relay for receiving the signals from the distant station, <sup>†</sup>It is wound with two distinct wires arranged in such a manner that the current from the <sup>main</sup> battery G ~~shall~~ pass through each wire in opposite directions to ~~to~~. One helix is in the circuit of the main line.

The other is in the circuit of the artificial line.

When the Rheostat in the artificial line is adjusted to offer a resistance to the passage of the current equal to that offered by the main line. The passage of the current from the battery G over both lines will produce no effect on the relay A, as the tendency of the main line bobbin is to produce a north and south pole in the Cores of the relay while the effect of the bobbin in the artificial is just the opposite & neutralizes this tendency and no magnetism is produced.

† I show two helix of wire so as to illustrate the principle more clearly but the wires are usually wound side by side

#### 4 Duplex

should the resistance of one circuit be less than the other, then the balance more current will pass in the circuit of less resistance and the excess will manifest itself by ~~on the relay~~ by attracting the armature of the relay with a force proportional to the excess of current passing in the circuit of lowest resistance,

It is a lever operated by a local magnet in a local circuit broken by the transmitting key K.

This ~~lever~~ <sup>lever</sup> A is connected to Earth, a is a spring ~~insulated from~~ secured to a piece of Vulcanite on the lever H. ~~This spring~~ <sup>and</sup> is connected to the jointed circuit, main & artificial line.

When the lever A is unattracted by the local magnet the spring is in contact with the ~~Earth~~ <sup>or</sup> ~~through the lever A~~ <sup>the proximal end of the</sup>

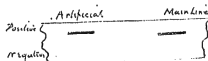
~~a contact point in connection with~~ ~~the main battery G.~~ ~~But when the~~ ~~the current from the distant station will~~ ~~have a clear route to the earth.~~ ~~When~~ ~~the lever A is attracted~~

~~the spring~~ by the local magnet  
is attracted, the spring is disconnected  
from the South lever and Earth  
& connected to the point c and  
battery to Earth, ~~R1 and R2 are~~  
small resistance coils inserted to  
<sup>reduce</sup> prevent the spark at the moment  
when the separation of the spring  
from the lever takes place  
as at the moment the battery  
is "short circuited" It will be  
observed that in signalling that  
the battery is connected &  
disconnected without breaking  
the circuit or materially altering  
the resistances, and as the action  
effects of the battery is not upon  
receiving relay it follows that  
if the strength of the current  
within the main line is increased  
by adding the battery at the  
distant station, that the  
balance will be destroyed  
and the relay lever will be  
attracted each time the battery

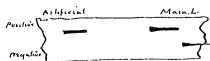
6 Duplex  
at the distant end is connected  
on disconnectedly the battery G.  
The relay still responds to the  
current of the distant battery.  
So far this method answers for short  
lines as between ~~about~~ of 80 and  
100 miles, but on longer lines another  
interfering cause arises which  
called static induction and the  
object of the Condenser C is to  
compensate for this phenomenon &  
serve the balance necessary  
for perfect signalling.

12(2)

# 7 Duplex.



If the main line has considerable electro-  
static capacity the record will be as  
shown in fig on closing and opening



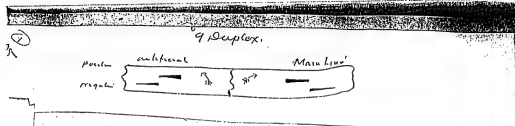
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### 8 Duplex

present a different appearance



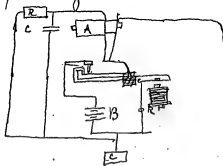
It will be noticed by referring to the records both of the main and lines present nearly the same apt. The charge from the condenser, same strength as that of the line is of very short duration as well discharge. The reason of this is charge and discharge of the L effected through a considerable while that of the condenser is so soon it can discharge this result is through a very slight resistance. If the condenser be divided up into parts and distributed over the resistance coils as in fig 1h and discharge may be made equal to that of the main. fig will show the record when balance is perfect.



Photocopy. Original is in Scrapbook, Cat. 297, Notebook Series.



In a Duplex apparatus <sup>which</sup> signals can be transmitted in opposite directions the main feature is to neutralize the effects produced by the outgoing current upon the receiving instrument the second feature is to keep the main line while signalling nearly at a constant resistance this result was first obtained by Mr Stearns on the ordinary heliograph circuits the mode of obtaining a constant resistance was devised by Messrs Farmer many years ago and subsequently adopted by Mr Stearns  
Stearns Method.



No 2  
A is the Duplex relay for receiving the signals from the distant station it has double coils wound around its cores in opposite directions to each other so that the current from the battery B passes through one helix in one direction to A and through the other helix in an opposite direction one helix is in the line wire the other helix is in an artificial line of the same resistance made so by a set of resistance coils X if the line on which this relay is placed is but a few miles in length the artificial line composed of resistance coil will exactly imitate and produce the same effects as the line wire when the resistance of both are equal the battery B when thrown in circuit by the attraction of the sounder lever transmits a current of the same strength upon the regular and also upon the artificial line these currents passing through the two helices of the relay tend each to produce a magnetism in the cores opposed to each other consequently no effect is produced upon the relay any excess of current due to the battery A at the distant station passes through one helix only hence the relay responds to any excess of current either on the regular or artificial line now if the line upon which one helix of the relay is placed is long the extra effect produced in it is not produced upon the artificial line although both may have them

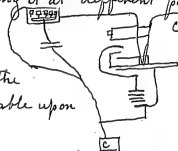
No 3

duplex

Some resistance. This extra effect is called static induction ~~and any equal amount~~ which and this static induction must be produced upon the artificial line before an exact balance can take place to produce the same static charge upon the artificial as produced upon the line Mr. Sturms inserts a condenser in the manner shown in figure one when the current from the battery B is ~~thrown~~ upon the regular and artificial line the line and condenser both produce a static charge in the same direction as the battery current balancing themselves in the double helices of the relay while the battery remains on the line which is in fact a condenser & condenser become statically charged so that when H is disconnected a static charge flows out of the regular and artificial line in the opposite direction to the battery current but as before owing to the reverse direction in which the wire on the relay is wound the neutralize each others effect from the condenser may be varied as shown in figure 2 we by connecting it at different points of potential

This method of does not produce scarcely noticable upon

Connecting the condenser the same effects as that line the difference is short lines

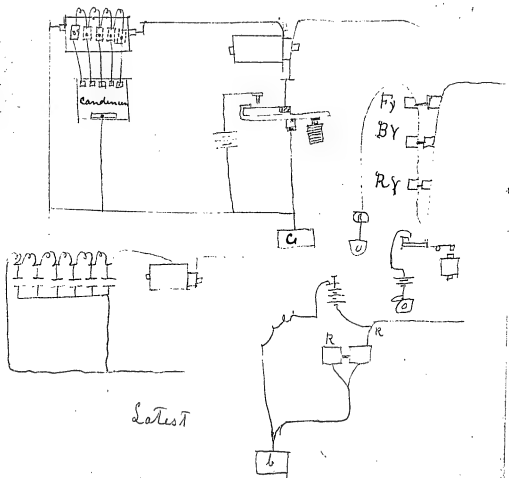


No 4.  
and the imitation is practically sufficient but when  
when the line is very long and its static capacity very great  
this method of connecting the condenser does not give a perfect  
balance the line itself being a condenser or accumulation  
of static electricity distributed along the entire length it  
follows that each successive mile from the battery receive less  
charge than the one before it the condenser is of the artificial  
line is immediately charged being in direct contact with the  
two poles of the battery when the battery is disconnected the  
condenser is quickly discharged but not so with the line  
the static charge accumulated at a distance from the battery  
must pass through a resistance which of itself is an accumulation  
of static electricity this charge will flow out of the line  
some time after the condenser on the artificial side has  
discharged itself which it does through no resistance this  
will of course throw the two ~~circuits~~ circuits out of balance  
and interfere with the signal from the distant station the  
effect being to strengthen and weaken these signals as for  
instance the letter H on closing and opening would be  
recorded ----

more closely imitated or produce the conditions of the  
main line upon the artificial line the rheostat should  
be composed of a large number of small resistance coils.  
between which a few leaves of the condenser is inserted

No. 5

This will distribute the static accumulation throughout the whole length of the artificial line and the time of charge and discharge can be made the same figure 3 shows this method

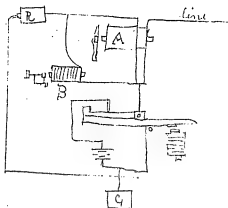


No 6

it is obvious that if the phenomena upon line any  
Telegraph circuit is exactly imitated and produced  
upon the artificial circuit that we will produce  
a perfect Duplex telegraph as regards this one  
particular - it is known when the two circuits have been  
balanced that if an ordinary relay is inserted in the  
regular line the balance will be partially destroyed  
owing to the induction discharge from that relay but if  
another relay of the same kind and of the same resistance  
is inserted in the artificial line this effect is equated for  
but this relay in the regular line will weaken the first  
part part of a dash received upon the relay from the  
distant station and prolong it after the battery has  
been disconnected at that end but this effect is not so  
noticeable as that produced by destroying the balance  
there exists another defect in this form of duplex which is  
the cause of considerable trouble which is the self induction  
of the relay itself there is of course no self induction  
due to the outgoing battery but with the incoming current  
of the distant battery the case is different the helix in the  
the artificial circuit act as a secondary coil and the  
helix connected to the line is operated by the distant  
battery <sup>comp</sup> forms the primary - The accumulations  
connected to the artificial line

No 7

to augment the strength of the induction waves induced into the secondary helix by the primary were their no accumulation connected to the artificial circuit the strength of the wave would be little but these serve to increase its strength  $\frac{1}{2}$  which reacting upon the relay makes the received signals very irregular the amount of induction may be determined by inserting a delicate polarized relay in the artificial line when the battery B is not being operated the battery disappears with a condenser to obtain an artificial line and produces the same effect by the induction action of an electro magnet fig 4 shows this arrangement



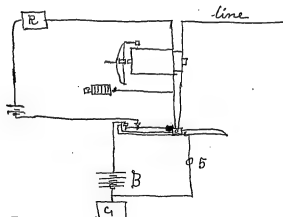
B is an electro magnet twice or thrice the resistance of one of the helices upon the relay it is also longer than the coils of the relay it is provided with an armature which

No 8

The core or adjusted some distance from them the purpose of which is to increase or decrease the length of its induction discharge the closer the armature the core of the electromagnet the greater will be the length on discharging time. when the battery B is connected permanently no induction action takes place in the relay the electromagnet B is charged and the regular line also at the moment of disconnection the battery the line discharges its static electricity through the inner helix of the relay but at the same time the magnet B sends an inductive discharge equal in strength and length to the static charge from the line through the second helix thus preserving the balance the circuit in which the induction discharge from the magnet has only the resistance of itself and one of the helices of the relay the induction circuit is shown by the dotted lines in this case the induction from the line helix of the artificial line has less effect than when the condenser is used the charging discharging time of the magnet B can be almost indefinitely increased by increasing the length of the magnet by this arrangement a local circuit operated by a small battery may be employed which is not possible with the condenser system thus in fig 5



No 9



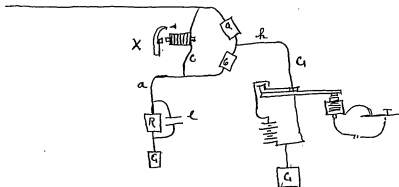
Mr. Stearns inserts a slight resistance in the wire 5. for the purpose of preventing the entire short-circuiting of the battery and, also to lessen the spark at the contact points. if this resistance be too small and several duplex circuits are worked from the one battery as is usual in the American closed circuit system signals will be quite irregular on all and especially upon the longer circuits as either one or the other of the contact points of the several duplex are constantly short-circuiting the battery. This rapidly exhausts it down increases its internal resistance to a point where with the two circuits of one duplex and several duplex working from the same battery with leakage and intermittent short-circuiting, nevertheless the external resistance lower than that of the battery when this takes place the opening

No. 10

and closing of one duplex circuit will be noticed  
an other duplex working from same battery at the  
distant station but not so appreciable at the station where the  
battery is the remedy for this is obvious the authors duplex  
Relay a description of which was published in the Telegraph  
several years ago was at first adopted by Mr Stearns but  
subsequently abandoned for the Siemens Holke Double coil  
relay the former consisted of two Magnets facing each other  
with the armature between them the defect of this relay is that  
a perfect balance cannot be obtained as the approach of the  
armature towards one or the other magnet destroys it and  
reason which is that if a given current is sent through line separated  
Magnets one of which is partially magnetized the latter will change  
sooner, A difference - the quality of the iron or in the  
length of magnet or the manner of convolution owing to self  
induction will occasion difference in the charging and  
discharging times of the 2 Magnets if the equalizing magnet  
is adjusted nearer the armature than the line magnet and  
the difference being equated for by increasing the resistance of  
the circuit in which the equalizing magnet is placed the effect  
of the close approach of the armature will increase the secondary  
charges within the equalizing circuit and increase the discharging or  
discharging time if all these conditions could be  
compensated for this form of magnet would undoubtedly be

shorter than <sup>No 12</sup> the double coil as no currents would  
 be induced into the secondary or equalizing circuit by  
 the primary main line coil. Mr. Dearns has recently  
 introduced a modification of his duplex which modification  
 consists in placing the receiving instrument in the bridge  
 wire of the Wheatstone bridge the advantages of this modification  
 over the other plan is short it does not depend upon the —  
 of the operation employed it will work as well with a mirror  
 galvanometer as with the ordinary Morse relay no special form  
 of apparatus is required except resistance coils the disadvantage  
 is that the receiving instrument is rendered less delicate a  
 portion of the working current need from the distant station  
 passing through the shunts around it the main disadvantage  
 being that this shunt from a route for the discharge of the  
 inductive currents of the receiving instrument thereby  
 enormously increasing the charging and discharging time  
 of the receiving — A, B, are adjustable resistance  
 coils which independent of the other connection form a shunt  
 around the receiving instrument D is the artificial line —  
 R the rheostat for make the resistance equal to the  
 line G and E the condenser to produce a static charge  
 upon the artificial one to balance the static charge upon  
 the regular line H is the battery wire placed at the central  
 point of resistance of the shunt CI is the usual device

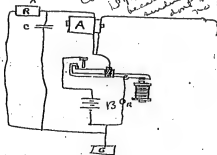
for connecting and disconnecting the battery if the rheostat  $R$  is adjusted so that it shall have the same resistance as the line wire and the condenser  $C$  has the same if the receiving — be a mirror galvanometer the induction currents generated are very weak and will scarcely disturb  $B$  working but if the ordinary Morse relay is used the induced currents are produced a mutilation of the signals shorten the cones of the receiving magnet and the self induction figure 2 show this method



capacity as the line then there are two wires one on one side of the instrument and one on the other side of the instrument both having the same resistance and capacity if the the astate  $A$   $B$  are equal and resistance and the battery is connected to the bridge by the upward movement of the Saunders lever at

In a Duplex apparatus by <sup>signals</sup> ~~messages~~ can be transmitted in opposite directions. The main feature is to neutralize the effects produced by the outgoing current upon the receiving instrument. The second feature is to keep the main <sup>whole circuit</sup> line at a constant resistance. ~~The first was~~ <sup>in this respect</sup> perfect neutralization was first obtained by Mr Stearns on the ordinary <sup>length</sup> circuits. The mode of obtaining signalling through a constant resistance was <sup>designed</sup> ~~invented~~ & patented by Moses G. Farmer many years ago. This ~~mode~~ <sup>method</sup> ~~was~~ <sup>has</sup> been adopted by Mr Stearns.

Stearns method



The reason why this will work is that it puts a relay in at each station where it is difficult to send a message back in.

A is the Duplex relay for receiving the signals from the distant station, it has double coils wound around its cores in opposite directions to each other, so that the current from the battery B passes through one helix in one direction and through the other helix in an opposite direction. One helix is in the line wire the other helix is in an artificial line of the same resistance ~~as the line wire~~.

made so by a set of resistance coils X. If the line on which this Relay is placed is but a few miles in length, the artificial line composed of resistance coil will exactly imitate and produce the same effects as the line wire, and if when the resistance of both are equal, the battery B when <sup>shown by an</sup> ~~connected to the line~~ by the ~~attaching~~ of the sounder lever, transmits a current ~~both on~~ of the same strength upon the regular and also upon the

The artificial <sup>line</sup> These currents passing through the two helices of the relay tend each to produce a magnetism in the cores opposed to each other consequently no effect is produced upon the relay. ~~A current~~ <sup>an excess of</sup> current <sup>due to the battery at the</sup> coming from the distant station passes through one helix only hence the relay responds to any excess of current either on the <sup>on</sup> ~~one~~ ~~line~~ regular ~~line~~ or artificial line.

Now if the line ~~be on~~ upon which <sup>one helix of the</sup> the relay is placed is long. The artificial line there is an extra effect produced which is not produced upon the artificial line although both may have them same Resistance. Therefore to this extra effect is called <sup>any signal current which may be induced from the</sup> static induction. and this static induction must be produced upon the artificial line before an exact balance of effects can take place =

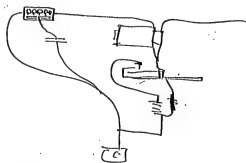
4.

If in this arrangement the regular line  
an extra artificial line is substituted  
for the regular line

to produce the same static charge  
upon the artificial as upon the line  
is produced upon the line, a Condenser  
must be connected as shown in fig  
1. The capacity for generating a  
static charge Mr Stearns inserts a  
Condenser in the manner shown in  
figure one. When the current from  
the battery B is thrown upon the line  
regular and artificial line. The line  
and condenser both produce a static  
charge in the same direction, as the  
battery current. Balancing themselves  
in the double helices of the relay  
while the battery remain on  
the line. <sup>which is, in fact, a condenser</sup> & Condenser become  
statically charged so that when  
it is disconnected a  
static charge flows out of  
the <sup>regular and artificial</sup> line ~~and artificial~~



~~line~~ <sup>it</sup> in the opposite direction  
 to the battery current, but as  
 before owing to the reverse direction  
 of the two wires in which the  
 wire on the ~~the~~ Relay is wound  
 the neutralizing each other effect  
 on the relay. ~~But if~~ The discharge  
 from the Condenser may be varied  
 as shown in figure 2. ~~the~~ by  
 connecting it at different points of  
 potential



~~It is obvious that~~ This method of  
 connecting the condenser does not  
 produce the same effects as that  
 produced upon the line, the difference  
 is scarcely noticeable upon short line

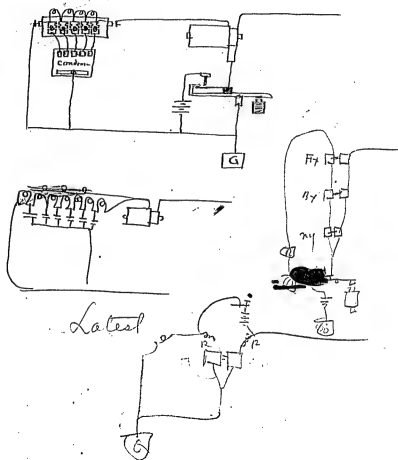
and the imitation is practically sufficient. but when the line is very long and its static capacity very great. this method of connecting the Condenser ~~does not give a perfect~~ ~~to prevent~~ balance. The line itself being a Condenser or ~~an~~ <sup>an</sup> accumulator of static Electricity distributed along ~~the~~ <sup>its</sup> entire length. It follows that each successive mile <sup>from the battery</sup> receives less the charge than the one before it, but the condenser <sup>of the artificial line</sup> is immediately charged, being in direct contact with the two poles of the battery. When the battery is disconnected the condenser is quickly discharged but not so with the line it ~~must~~ discharge the static charge accumulated at a distance from the battery must pass through a resistance which of itself is an accumulator of static Electricity. This charge will flow out of the line some time after the Condenser on the artificial side has discharged itself which it does through

no resistance this will of course throw  
the two circuits out of balance  
and interfere with the signal from  
the distant station it will the effect  
being to strengthen & weaken these  
signals as for instance the letter  
H .... on closing & opening would be  
recorded ....

To more closely imitate or produce the  
conditions of the main line upon the  
artificial line the Resistance  
Coil Rheostat should be composed  
of a large number of small resistances  
coils between which a few leaves  
of the Condenser is inserted, this  
will distribute the <sup>static</sup> accumulation  
at a great number of throughout  
the whole length of the artificial  
line and the time of charge  
and discharge can be made the  
same figure 3 shows this  
method =

8

~~Edison's~~



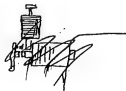
It is obvious that <sup>of the phenomena</sup> ~~a line of great~~  
~~length and of great static capacity~~  
~~obtained upon~~ upon the line any  
 telegraph circuit is exactly imitated  
 or and produced upon this artificial  
 line connected to circuit that we  
 will produce a perfect Duplex  
 telegraph as far as regards this  
 one particular = It is known  
 that <sup>when the two circuits have been balanced</sup> if an ordinary relay is  
 inserted in the regular line, the  
 balance will be partially destroyed  
 owing to the inductive discharge  
 from that relay. But if another  
 relay of the same kind and of the  
 same Resistance is inserted in  
 the artificial line, this effect is  
 equated for, But this relay in  
 the regular line will weaken the  
 first part of a dash  
 received upon the relay from the

distant station and prolong it  
after the battery has been  
disconnected at that end.  
But this effect is not so noticeable  
as that produced by destroying  
the balance,

There exists another defect in this form  
of Duplex which is the cause of  
considerable trouble which is the  
self induction of the Relay itself.  
There is of course no self induction  
due to the outgoing battery but,  
~~the helix of the~~ with the incoming  
<sup>current of the distant</sup> battery the case is different.

The helix ~~comes~~ within the artificial  
circuit acts as a secondary coil  
and the helix connected to the line  
& operated by the distant battery  
forms the primary. The accumulators  
connected to the artificial line —  
serve to augment the strength

of the inductive waves induced into the secondary helix by the primary were there no accumulators, connected to the artificial circuit the strength of the wave would be little but these serve to increase its strength  $\frac{1}{2}$  which reacting upon the relay makes the received signals very irregular. The amount of induction may be determined by inserting a delicate potentiometer in the secondary circuit. The author dispenses with a condenser upon the line to obtain an artificial line, and produces the same effect by the inductive action of an Electro magnet. Fig 4 shows this arrangement.



polarized

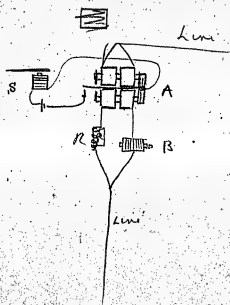
~~amount of induction may be determined by inserting a delicate potentiometer in the secondary circuit. The author dispenses with a condenser upon the line to obtain an artificial line, and produces the same effect by the inductive action of an Electro magnet. Fig 4 shows this arrangement.~~

### Induction Relay.

~~Self~~ This is a very effective and delicate Device and is found to work well in practice ~~it is~~ <sup>it is</sup> a self adjusting <sup>magnet</sup> It will work between the greatest extremes of battery power without requiring adjustment and has the peculiar advantage of working under any condition, it is far more delicate than the same relay worked by induction from a secondary coil for in the latter case the induced current is of very high tension & very weak whereas in the former case the strength current is of a tension not much greater than the main current &



has almost the same power  
fig - shows this device



A is the polarized Relay with  
double release preferably.

2  
would two wires wound side by  
side the current which passes  
through each in opposite  
direction like a Duplex  
but show as separate bobbins  
so as to convey a clear idea  
of the connection.

The two pair of bobbins are  
arranged so that the current  
in one branch of the main  
line shall pass through  
in one direction whilst  
current in the other  
branch shall pass  
through in an opposite

[3]

direction, within one branch  
is included an ordinary Electro-  
magnet with 100 or 200 Ohms Resistance  
with its armature in Contact  
or it may be an ordinary  
Relay - in the other branch  
is a resistor which must  
be so adjusted that the  
resistance of both branches  
are exactly equal or of  
such a resistance that  
the effect of the main  
current is exactly balanced  
in the polarized Relay  
A.

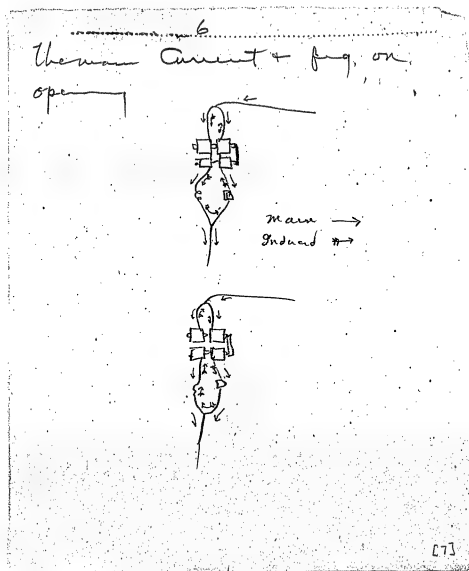
[4]

If now ~~the~~ plain resistance was substituted for the magnet B. opening & closing the main current would produce no effect on the polarized relay: but when the magnet is in the circuit on closing the ~~the~~ main current an inductive discharge from the magnet B circulates within the local circuit (as far as the induced current is concerned) the first part of which is nearly as strong as the main current, this current ~~is~~ unlike the main

C53

Current passes through the  
 two helices on the delayed  
 relay in a direction necessary  
 to produce Magnetism in  
 the Cores, if now the main  
 Current is broken an induced  
 Current of the same strength  
 but of an opposite character  
 to the Current generated on  
 closing the main Current  
 circulates with the closed  
 Current & throws the  
 tongue over to the other  
 point - ~~Diagram~~ X — will  
 show the direction of the ~~same~~  
 induced Current on closing

[6]



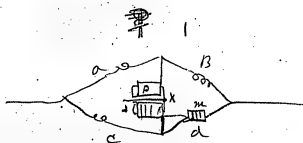
7.  
The polarized relay is self-adjusting  
for any current above which  
does not fall below the point  
which it necessary to produce  
an induced current to move  
the polarized tongue -

The induced magnetism may  
be increased by increasing the  
Resistance, or length of magnet  
or decreased by disconnecting  
the armature from the face  
of the Core shortening the magnet  
or reducing the resistance.

This relay will give good  
signals with 10 cups of  
battery at each end of a  
300 mile No. 9 wire. Current

[8]

in ordinary weather -  
 figure shows another plan  
 whereby the double Coils are  
 disposed with -



The Resistance of all the  
 branches ~~are~~ a b c d  
 are equal, when the  
 main line is closed no  
 current except the induced

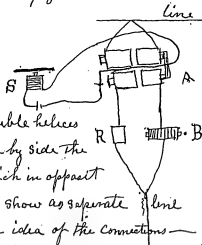
[9]



# No 1 Induction Relay

COPY original by TNC

This is a very effectual and delicate device and is found to work well in practice as a magnet it will work between the greatest extremes of battery power without requiring adjustment and has the peculiar advantage of working under any condition, it is far more delicate than the same relay worked by induction from a secondary coil for in the latter case the inducted current is of very high tension and very weak whereas in the former case the current is of a tension not much greater than the wave current and has almost the same power - figure shows this device



A is the Polarized Relay with double helices preferably two wires wound side by side the currents which pass through each in opposite direction like a Duplex but show as separate line bobbins so as to convey a clearer idea of the connections -

The two pairs of bobbins are conveyed so that the current in one branch of the main line shall pass through in one direction while the current in the other branch shall pass through in an opposite direction within one branch is included on

ordinary Electromagnet with 100 or 200 Ohms Resistance with  
 its armature in contact or it may be an ordinary relay  
 in the other branch as a resistance which must be so adjusted  
 that the resistance of both branches are exactly equal or of  
 such a resistance that the effect of the main current is  
 exactly balanced in the polarized Relay if now plain  
 resistance was substituted for the magnet  $B_1$  opening <sup>the</sup> second  
~~main~~ closing the main current would produce no effect on the  
 polarized relay but when the magnet is in the circuit on  
 closing the main current an induction discharge from  
 the magnet  $B_1$  circulates within the local circuit (as  
 far as the induced circuits concerned) the first part of  
 which is nearly as strong as the main current this current  
 unlike the main current passes through the two helices on  
 the polarized relay in a direction necessary to produce  
 magnetism in the core, if now the main current is broken  
 an induced current of the same strength but of an opposite  
 character to the current generated on closing the main  
 current circulates with the closed circuit and throws the  
 tongue over to the other point — will show  
 the direction of the induced current on closing

## The main current fig one opening

The polarized relay is self adjusting for any current which does not fall below the point which it necessary to produce an induced current to move the polarized tongue the induced Magnetism may be increased by increasing the resistance or length of magnet and decreased by disconnecting armature from the face of the core shortening the magnet or reducing the resistance this relay will give good signals with 10 cups of battery at each end of a 300 mile No 9 wire circuit in ordinary weather — figure shows another plan where by the double coils are dispensed with



This Resistance of all the branches, A, B C D are equal when the main line is closed no current except the induced currents from the magnet — pass through polarized relay. P. This current circulates in the closed circuit formed by the wires, B, D, & X. The induction changes may be increased in strength by replacing the resistance in the branch on with an electromagnet of the same resistance

No 4

It will be seen that one of the branches must contain a device which will generate induction currents while the other branch must be a receiver of non production of these currents were it other wise both branches containing Electromagnets these induced currents would not circulate within the circuit formed but pass on the line

No. 211

Morse Telegraph Contends with Line

- 1 Secondary battery action
  - 2 Static charge
  - 3 Earth current Battery current
  - 4 Earth currents                      action of light on the whole
  - 5 induction                              polarization battery
  - 6 cross fire
  - 7 Variability of
  - 8 polarization leakage
  - 9 Leakage
  - 10 Relay discharge
  - 11 Earth currents
  - 12 These one with another produce Secondary phenomena
- Instrument
- 1 one self discharge of relay in leakage decomposition
  - 2 oxidation of points
  - 3 Shaking of relay points
  - 4 magnet's time of local magnet

6. Intake of moveable part
  7. Double Currents due to rebound of key lever.
  8. Oxidation Key points,
- 

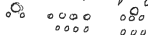


It is very probable that  
 the moisture on a insulation  
 when but slight that  
 the passage of a current  
 repels each globule or  
 breaks it up in small globules  
 repellent of each other  
 & then break the current  
 give a momentary charge (10) static

8b)

This appears to be a continuation of (8a) in Edison's hand. (1 page).

- 4
- 5 <sup>Key</sup>  
of Movable parts
- 7 Double currents due to rebound of Key lever
- 8: Operation Key points



It is very probable that the moisture on a insulator when but slight that the passage of a current repels each globule and breaks it up in small globules repellant of each other and then breaks the current give a momentary change (1c) static

No 1

Chemical paper well made Iodide paper should give a mark through 500 000 Ohms with one Daniell cell - The Resistance of Iodine paper is when moved continuously to prevent insulation of the stylus by free iodine is another resistance decrease as the battery increases - See if so Manganese salts have much less delicacy than The most inferior ferrocyanide paper The most perfect writing is obtained when it is almost dry for then there is no spread of writing and no mechanical attenuation which although extremely slight with Iodine solutions yet exist and give the signals a pointed appearance Attempts have been made to substitute a recording roller in place of the points so as to allow of a greater press but unsuccessfully on account of the covering of chloride matter which it receives when the first signal is sent - when Sulphanet of paper is used polarization of the pen is greater than with the ferrocyanide and the sulphide of iron which still remains on the pen after a signal insulates the pen and it is not unresoluted until the current has passed for some time through breaking down the insulation ammonia chloride sal so a gill of water add tea spoonful nit Ammonia to this add what is held on small knife blade of ~~ferrocyanide~~ sodium the paper is white with iron pen marks are blue with tin pen They are yellow at first but soon turn



purple - (Purple of Cassius) the sensitiveness is increased by adding slight amount of bichloride mercury less than onechloride sodium but there appears after a few hours a continuous line running through the signals the  $\text{Chl. Sodium}$  does not answer as well as the Nitrate of Ammonia the excessive amount of Iodide of Potassium which is necessary to be used to give delicacy to the paper led me to believe that only a certain amount was necessary to give a good mark the excess merely acting to reduce the resistance of the paper but I found that by using less Iodine and adding conducting salts in the same proportion as the lesser amount of Iodine that the sensitiveness was reduced to the proportional amount of Iodine in the paper the signals received on Iodine paper when quite damp fade within one hour but if really dry paper is used the marks are perceptible for several weeks afterwards. Varnishing the strips to prevent the air from coming in contact with the free Iodine does not prevent the disappearance of the marks - with the fumed Cyande solution if a little Starch be added the marks have a deeper color - The resistance of very dry Iodized paper through through a meson Gal of 3500 ohms is with one cup 50 000 will five cups 100 000 Iodized paper will show a good black dot with one cup of battery through

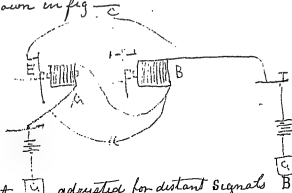
No 8


One Million ohms in 6 Seconds will fire cups it gives a good continuous marks capable of recording 100 words per minute decreasing the thickness of the paper does not probably decrease its resistance of Sulphocyanide of potassium to which is added Hydrochloric acid or muscat Tin —

Quit formal white marks be recorded on Read back ground Logwood wood solutions find out more about it. It sometimes occurs that in compass galvanometer having a glass cover and insulated that the needle is attracted to the metallic index this is caused by cleaning the glass with a cloth the glass becomes electrically excited and the needle is attracted it may be discharged

In the American system of working by permanent currents considerable difficulty is experienced in doing weather from the escape current or leakage especially at terminal stations. This current which is in proportion to the leakage becomes so powerful in wet weather that the armature must be moved a considerable distance from the face of the cores to obtain a practical adjustment and also to reduce the self induction of the magnet itself the latter being the main trouble as the ground on one side and the combined derivations or leakage on the other side of the relay in which the induced currents can circulate hence placing the armature at a greater distance from the cores reduces the strength of the self induction at the square of the distance it also brings the armature out of the influence of the permanent current. but at the same time the magnetic effect of the received currents is reduced at the square of the distance. On wires of very bad insulation and on which relays of considerable length are used the distance of the armature from the face of the cores sometimes must be  $\frac{1}{2}$  of an inch to obtain a practical adjustment hence not one tenth of the current is utilized which could be if the armature was nearly in contact with the core, the shorter the cores of the magnet is the nearer the armature may approach the higher the resistance the greater

will be the effect of the leakage current numerous attempts have been made to render the effect of the leakage current nugatory on the receiving relay—among which may be mentioned Kearns and Smith. Kearns device is described in Lamb Schellen and Sabine Smiths device is shown in fig. c



A. is a relay magnet  adjusted for distant signals B is another relay which may work an ink recorder or act as a sounder etc both are in the main circuit when the current ducted the distant battery ceases the armature of the relay, A, flies a way from magnet and makes contact with the points E, and short circuits or shunts the magnet, B, by the wires C. D. when the distant current is on the relay lever of A, is drawn forward the shunt is removed and the current due to the escape and distant current energizes the magnet B— but a local might be passed through the magnet, B, and produce precisely the same effect, and it still leaves the coils above enumerated untouched in this <sup>101</sup> ①

### Market Printing Telegraphs.

Within the last few years an entire new branch <sup>in this class of</sup> of telegraph instrumentation has been created in this country, ~~the latest market prices~~

~~The~~ All the <sup>late</sup> quotations of the New York Stock Exchange are distributed to upwards of 1000 brokers Offices during the day from a Central Office, by means of a ~~modification of the original House~~ <sup>step by step</sup> Printing Telegraph, diminutive printing Telegraph instrument, and they have proved of great value to the Commercial Community as well as a source of profit to the Companies who operate them. At the present moment there is about 3 million of dollars invested in this Enterprise branch of telegraphy. There are several classes of printers used, <sup>the principles</sup> ~~all of which~~ are based on the ~~principles~~ of the author with the exception of

one,

In a printing telegraph it is necessary to perform two distinct operations over the type wheel and actuated the printing lever. The manner of accomplishing this result over one wire are mostly described in figs.

Chapter on Movements — figures —

Shows more clearly the application of the <sup>1st</sup> principle of the instruments which have produced the best res. been adopted,

fig- is the first self acting one wire machine of this class invented, and although not at present greatly used, on account of the capricious action of the polarized switch is undoubtedly the most perfect device for producing two movements at a distance on one wire by magnetizing

Spring

as it does not depend upon of an even  
or rapid transmission of waves to effect  
the result but will act with the slowest  
as well as the most rapid pulsations,  
for this plan, <sup>since no appeal to a printing delay</sup> is already described in a  
previous Chapt. (Inf.) Suffice it to say  
that when positive currents are transmitted

(c) interruptions of a permanent positive  
current, is made the polarized bar of the  
polarized Switch magnet is thrown to that  
side which shunts the printing lever  
magnet out of circuit, and providing  
nothing interferes with the proper action  
of the polarized bar Switch, This magnet  
will ~~would~~ never become active until  
a negative current was sent when  
the switch bar would fly to the other  
side of the Contact point & shunt the  
type wheel magnet. One of the reasons  
why these switches were not positive  
in their action was that the bars <sup>stick</sup>

4 points.

were not sufficiently magnetized for  
if pl of a permanently magnetized bar  
be actuated by a very strong magnet.  
the force with which it will be moved  
will be in proportion to the magnetism  
in the bar, if it were an <sup>an</sup> iron bar and  
Contact between the two magnet Cores.  
The tendency of one Core would be to  
pull it one way and the tendency of the  
other Core to pull it the other way  
now hence it would not move.  
But if it have a slight directive force  
or permanent magnet it will be drawn  
with a force to one pole or the other, according  
to the polarity of the magnet, with a  
proportionality to the permanent magnet  
no matter how strong the magnet may  
be. This was not well understood when  
these switches were first introduced and  
the permanent magnetism was so feeble  
that the most powerful current in the  
switch magnet would the bar would  
scarcely make Contact with the  
right or left point necessary to



shunt the magnets and produces  
the desired results. Another defect  
was that the lightning depolarized  
the switch bars & necessitated  
remagnetization - from these reasons  
instruments using this device have  
now been almost abandoned.  
With strongly magnetized bars this device  
is as reliable as any device used in  
telegraphs -

(Note mention that owing to the small quantity of  
the switch lever that the no coil results are produced by the  
passage of the switch lever from one point to the other even when it is  
first.

In abandoning the polarized switch

fig. Shows an entire new principle for  
obtaining the two movements on one wire  
and this principle has now been adapted  
in all the one wire machines now in  
use. This principle is based on the  
fact ~~discovered~~ <sup>noted & demonstrated</sup> by the author that  
when rapid reversals were transmitted  
within a closed circuit containing an  
electromagnet and an a polarized

6 pages

magnet, the lever of the polarized magnet would be actuated with considerable force while the attraction of the ordinary Electromagnet for its armature would be scarcely perceptible,

This device is shown in figure -

The author first used a very short Electro polarized magnet, one Siemens principle in conjunction with a long Electromagnet but subsequently added a <sup>shunt</sup> around the long Electromagnet equal in Resistance to the magnet itself, ~~etc~~

Without the shunt it requires that the reversals should be sent within the circuit at a certain speed otherwise any slow speed will allow the Electromagnet to act. But with the shunt. The discharge of the Electromagnet itself is not prevented from acting against the polarized magnet & reducing its power but circulating within the closed circuit formed by the shunt & the core of the Electromagnet

by printer -  
increase immensely its charging &  
discharging time hence very slow  
reversal may be sent into the  
circuit without any danger of  
actuating the lever of the  
Electromagnet. The shunt device  
is shown in fig.

This principle has been adapted in  
what is known as the Manhattan  
Printer but with slight modification

This is shown in fig. C is a separate  
Electromagnet prevented from working  
by the rapid reversals. A-A is the  
delayed magnet operating the type  
wheel B the printing magnet.

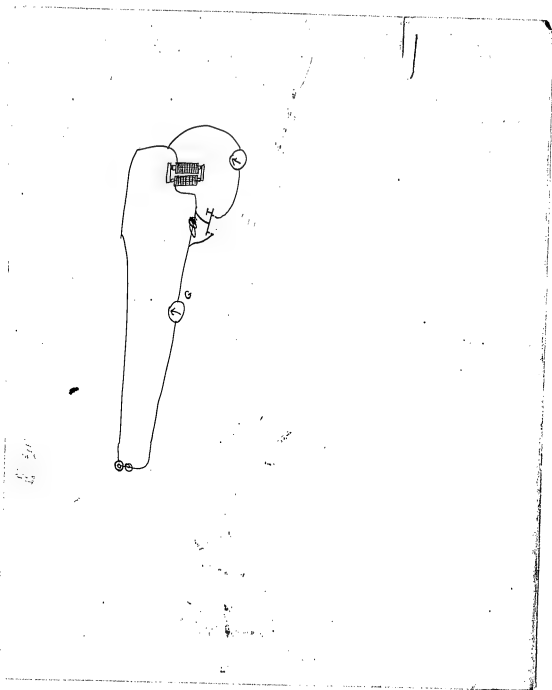
When rapid reversals are transmitted  
the lever of A-A. responds & the  
type wheel is rotated but the  
Electromagnet C & B <sup>for the reason above</sup> <sub>as before</sub> <sup>remain</sup>  
do not respond until the current  
is made permanent. when this  
takes place the lever of C.

is drawn down and the polarized magnet  
is short circuited, this decreases the  
resistance of the circuit and the  
magnet B becomes more powerful &  
gives a better impression of the letter,  
Of course the Extra magnet C may be  
dispensed with without in the least  
affecting the result,

Figure — shows another plan in  
which the magnets are not polarized,  
When there is no current in the circuit  
the type wheel lever is drawn up by the  
spiral spring and contact is broken  
at N-M. throwing the printing magnet  
out of circuit now when rapid pulsations  
of a given length pulsations are sent  
which are <sup>just</sup> sufficient to operate the  
the type wheel magnet into lever  
& no more the printing magnet will  
remain quiescent as but a small  
portion of the pulsation passes through  
it ~~on occasion~~ but if the current  
be made permanent the sufficient

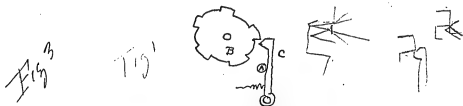
will pass through <sup>9 points</sup> P. to bring the  
printing lever up and effect the  
impression on the lever.

To finish the article get power  
from General Patent in  
Box document.



Break wheels.

Figure 2 <sup>represent</sup> shows a form of break wheel where <sup>up which</sup> the rubber or insulating substance between the teeth <sup>is</sup> dispensed with, and a limiting pin substituted, A.



This prevents the click c entering too far between the teeth <sup>and</sup> preventing any great depth in the space <sup>between the teeth</sup> by the pin A. ~~The defect of this break consists in the wearing away of the point of the wheel lessens the pressure <sup>of the teeth on the wheel</sup> as well as the point wearing square is liable to catch the po. Edges of the teeth on the wheel, <sup>of the rounded edge</sup> if the edge of these teeth be rounded, then the time or length of contact will be shortened as the point of C wears another objectionable feature~~

12)

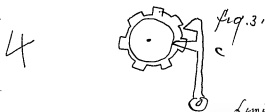
(12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a)

"Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

## Break wheel 2

is the pen <sup>A</sup> which moved in the slightest manner will increase or decrease the Length of Contact, in Proportion Step by Step printing Telegraph work this adjustability of Contact surface is especially objectionable ~~as it frequently happens that several adjustments as these~~ <sup>as it frequently happens that several adjustments as these</sup> a change in the length of Contact will create change the adjustment of the vibrating levers, Another form is shown of a roller is used Another form of break wheel is shown in fig 3



Limiting pin shown in fig 2  
in this arrangement the pen <sup>A</sup> fig 2  
— is dispensed with ~~as~~ The  
Contact lever C is provided

12)

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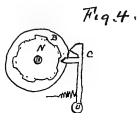
12a)

"Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).



### 3 Break wheel.

with a second point, which rubbing on an insulated wheel prevents the click from entering too deeply in the spaces. As the wear on both points can be made nearly the same the length of contact remains unaltered. Another form is shown in figure 4.



→ (5)

B is a smooth <sup>laced</sup> wheel the surface of which is covered with platinum, to prevent excessive oxidation.

N is a toothed wheel insulated from B. This wheel is provided with as many teeth as there are contacts to be made <sup>in one revolution</sup>. C is

the contact lever provided with an extra tooth X running in the path of the wheel N. <sup>These teeth the movement given to the tooth click by the teeth of N. Control the length of break. The spaces between the teeth should be shallow.</sup>

(12)

(12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

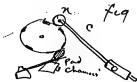
(12a)

"Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

and the two points <sup>4</sup> should be so proportioned that when contact is being made the tooth X should not touch the bottom of the space

with the plating of the wheel frequent the point X from dropping to the bottom of the space in the wheel <sup>at the</sup> ~~the~~ <sup>each</sup> ~~the~~ points. g. will not be <sup>be</sup> ~~the~~ length of contact, about the same

Another form is shown in fig 5



(6)

The <sup>rubbing</sup> contact point shown on the <sup>previously</sup> ~~previously~~ described <sup>where</sup> ~~break~~ wheels being replaced by a wheel in. This has great <sup>the</sup> ~~the~~ advantage <sup>obtained by using a wheel is that</sup> ~~as there is no rubbing it will give a better contact, and it will also~~ <sup>and with the same pressure as the rubbing contact it will not have</sup> ~~less pressure to form a perfect contact while several times the pressure may be put on it without a corresponding retardation of the~~

12)

(12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a)

"Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

5- Bk wh

another advantage is less  
break wheel and wear of Contact  
Joint. <sup>These are advantages</sup> The first is a very important  
consideration <sup>with</sup> ~~so~~ that class of  
apparatus which have but  
consume but little power to  
create the break = Where a  
roller is used a small <sup>watch spring Tipped</sup> ~~brush~~ <sup>brush</sup> should press  
lightly against the periphery  
of the wheel to remove the  
oxide formed by the spark ~~for~~  
and to prevent dust. Were no  
brush used the <sup>oxide</sup> ~~brush~~ would be  
drawn over the wheel and pressed  
on the <sup>oxide</sup> ~~plating~~ surface <sup>The tendency of wheel would be to</sup> form  
infinitesimal breaks of the  
circumference. This roller should be  
made as inflexible



12)

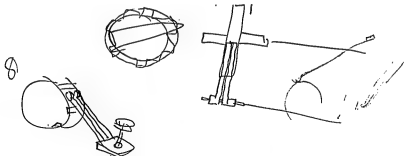
(12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a)

"Break Wheels," (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

# 6 BK Wheel

frequent two rollers or two point of contact are used as in fig. 12.



The object being to ~~preserve~~ <sup>use perfectly</sup> the ~~efficiency~~ <sup>contact</sup> of contact should one point fail, but extra ~~points~~ <sup>being</sup> required then. not  
Sometimes ~~the~~ <sup>the</sup> two contact points are connected as in figure - to lessen the spark. whenever very trouble and short circuits ~~with~~ <sup>even</sup> low resistance. Batteries are used. This method is very effective <sup>for that purpose</sup> on ~~the~~ <sup>lessening</sup> the spark, which ~~it does~~ <sup>at least two times</sup> ~~but then~~ <sup>increasing the</sup> liability of bad contact is <sup>to make</sup>

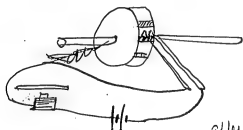
12)

(12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a)

"Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

augmented ~~but~~ <sup>7 however</sup> this may be  
remedied by increased pressure  
on the Con-Act points



(9)  
fig 4  
after this new let. fig 11

A much superior.

Another class of break which <sup>to those already</sup>  
described consists in using  
are much superior to those already  
described consists in using  
the revolving wheel <sup>which</sup> merely as a mechanical  
<sup>device</sup> arranged for vibrating the  
Contact Teas before a fixed Contact  
point - figure shows the  
method usually adopted -

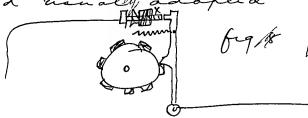


fig 11

12)

(12a) - (12e) appear to be related. These drafts all concern  
breakwheels and are by Edison and Charles Batchelor, with  
Batchelor's annotations on the Edison drafts.

12a)

"Break Wheels." (14 pages; page 13 missing; Edison's hand with  
Batchelor's annotations).

# 8 Breakwheel

The objections to this form are first. The oxidation is accumulated at one point instead of being divided over a large number of points as is the case with the devices already described, Secondly: ~~it~~ shortening of the ~~break~~ <sup>contact</sup> as the platinum point ~~was~~ are worn by oxidation, Third the rebound of the lever when it touches the rigid platinum point. ~~Levers of having~~ considerable mass, which ~~are~~ rebound when striking a rigid point. when a low motive power is used ~~and takes as much power~~ this rebound gives double ~~breaks~~ <sup>contacts</sup> when only one ~~break~~ <sup>contact</sup> is wanted, (see 182510). Although this interruption is ~~infinitely~~ <sup>very</sup> small. If the induction current of the Electromagnet is very sensitive to them (see ---) hence the time of magnetization of the magnet is prolonged. ~~This effect~~ <sup>effect of the</sup> may be entirely prevented by using a flexible spring ~~as in fig~~ <sup>as in fig</sup> the ~~next~~ <sup>next</sup> method shown in ~~fig~~ <sup>fig</sup> 9

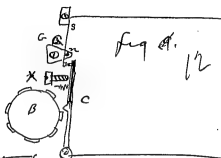
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12a)

"Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

9 Breakwheel



By the ~~the~~ <sup>although</sup> ~~the~~ <sup>the</sup> ~~case~~ <sup>the</sup> rebound of ~~c~~ <sup>the</sup> against the screw ~~X~~ <sup>the</sup> ~~is~~ <sup>is</sup> not sufficient to allow it to break contact with the ~~open~~ <sup>spring</sup> ~~platinum~~ <sup>pointed</sup> ~~spring~~ <sup>s</sup>.

The forward or backward motion of the spring is regulated by adjusting the plate ~~A~~ <sup>the</sup> ~~spring~~ <sup>may</sup> press with any degree of strength against the pin ~~n~~ <sup>which</sup> ~~is~~ <sup>is</sup> inserted in ~~A~~ <sup>A</sup> -

a method superior to this inasmuch as the spark chances of a mis-  
bad connection is reduced. ~~one~~ <sup>near</sup> ~~point~~ <sup>is shown in fig 16</sup> ~~be~~ <sup>the</sup> ~~always~~ <sup>oxidation</sup> ~~of~~ <sup>of</sup> ~~one~~ <sup>one</sup> ~~of~~ <sup>of</sup> ~~the~~ <sup>the</sup> ~~points~~ <sup>points</sup> ~~being~~ <sup>being</sup> ~~reduced~~ <sup>reduced</sup> ~~to~~ <sup>to</sup> ~~almost~~ <sup>almost</sup> ~~entirely~~ <sup>entirely</sup> ~~by~~ <sup>by</sup> ~~the~~ <sup>the</sup> ~~method~~ <sup>method</sup> ~~is~~ <sup>is</sup> ~~shown~~ <sup>shown</sup> ~~in~~ <sup>in</sup>

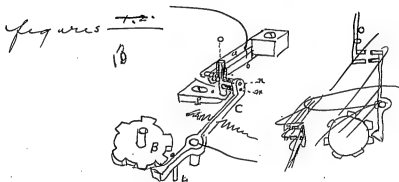
12)

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12a)

"Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

1073k wheel



C is the vibrating lever. on the end of which are two platinum points. One of the points being <sup>placed slightly</sup> in advance of the other a. b. are two contact springs both connected together having points of the same length. These springs hang the pin O on the movable plate P. The upper platinum point n being in advance of the lower point m. takes all the spark as it is the last point of commutation. The point m

12)

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12a)

"Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).



11 Break wheel

leaving to spring before M  
~~does~~ Therefore M is freed  
 from the oxidation caused by  
 the spark - temperature which  
 there is considerable spark.  
 The points and the contact  
 are being made very extremely  
 rapid ~~M & its~~ The point  
 M & its corresponding spring  
 will miss one contact in an  
 average of 500, when this  
 is the case the spark comes  
 on M. ~~but as this does~~  
 This of course <sup>causes</sup> oxidation the points  
~~are~~ but it will be a long time  
 before the oxidation becomes so  
 great as to <sup>cause bad</sup> ~~miss~~ contact,  
 After N has become very dull  
 after long use the contact will  
 still be perfect as the chances  
 of both M & N missing at  
 the same time are <sup>practically</sup> ~~infinitely~~ small.  
 The <sup>one of the</sup> ~~only~~ defects in this  
 arrangement is that the

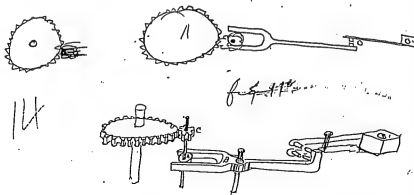
12)

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12a)

"Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

12 Rk wheel  
length of contact will shorten  
as the point on oxides; -  
The most perfect break in a mechanical point of  
view is that shown in fig 11. This  
is specially applicable to high speeds.



~~As with other breaks the  
teeth length will vary with~~

The Contacts are made as in fig 10.  
But But the toothed wheel which gives  
motion to the vibrating lever the length of  
vibration of which will vary as the  
rapidity of rotation of the toothed wheel  
increases, which is replaced by a gear pair  
& Cam wheel. A is the Cam wheel or  
Eccentric wheel working in the forked arm lever  
13.

12)

(12a) - (12e) appear to be related. These drafts all concern  
breakwheels and are by Edison and Charles Batchelor, with  
Batchelor's annotations on the Edison drafts.

12a)

"Break Wheels." (14 pages; page 13 missing; Edison's hand with  
Batchelor's annotations).

14 Bk wheel

It will be unnecessary to describe the defects of this <sup>new</sup> class of breaks, as ~~they~~ are liable to the same defects as the Single Current Breaks,

Fig shows another method.



120 (9)

12)

(12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12a)

"Break Wheels." (14 pages; page 13 missing; Edison's hand with Batchelor's annotations).

# Break wheels.

Figure 1 shows the form most in use in telegraphic apparatus

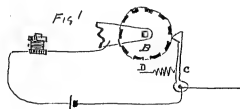


Fig 2



~~B~~ is the break wheel <sup>B</sup> divided as in fig 2 and the spaces between the teeth <sup>filled</sup> with vulcanite or Ivory. C is the contact arm held with ~~any degree~~ <sup>adjustable</sup> pressure against the periphery of the wheel by the spiral spring D. The teeth of the break wheel are generally faced with thin platinum foil. <sup>to insure better connections</sup> The point of the contact arm is also faced with platinum.

There are many objections to this form of break among especially when used in connection with an electromagnet, or a circuit and with a battery of low resistance, among these

12)

(12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12b)

"Break Wheels." Another version in Edison's hand. (5 pages with Batchelor's annotations).

objectionable features may be mentioned

1. To obtain the improper <sup>relation between</sup> ~~of~~ the contact surface ~~to~~ space,
2. The great tension or pressure which must be placed on the contact point to insure <sup>proper</sup> ~~proper~~ contact
- 3<sup>rd</sup> The destruction of the <sup>valuable</sup> ~~rubber~~ or Ivory by the scraping action of the contact lever
4. The ~~insulation of the~~ <sup>the imperfect connection caused</sup> ~~challenged~~ tooth by the compression of the dirt <sup>from the ivory</sup> ~~set the ivory~~ into the <sup>valuable</sup> ~~edge~~ <sup>which parts when a little worn</sup> ~~formed~~ by the contact lever.
- 4 The burning of the insulation at the point where the <sup>of breaking connection & thereby</sup> ~~contact point~~ leaves the tooth, prolonging contacts
5. The <sup>insufficient</sup> ~~improper~~ connection between the pivot of the <sup>breakwheel & the bearing</sup> ~~break wheel~~, when in motion.

6<sup>th</sup> The excess of spark due to the accumulation of platinum dust in the <sup>space caused</sup> ~~the~~ <sup>by the burning away of insulation</sup> ~~formed after a tooth~~

Regarding the first objection it may be stated. That to obtain the greatest <sup>full result</sup> number of vibrations from an <sup>armature</sup> ~~magnet~~ lever. The contact surface of the <sup>plate wheel</sup> ~~tooth~~

12)

(12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12b)

"Break Wheels." Another version in Edison's hand. (5 pages with Batchelor's annotations).

should have twice the surface <sup>of the break, or</sup> ~~the space~~  
<sup>space between</sup> ~~between~~. The reason for this is obvious  
 when we consider that upon closing a  
 circuit in which there is an electromagnet  
 that the ~~discharge~~ <sup>secondary</sup> current of that magnet  
 sets up an opposing EMT to that of the  
 battery ~~at the magnet being on a closed~~  
~~circuit~~ <sup>which</sup> prevents the magnet from  
 being charged immediately, hence <sup>the extra</sup> ~~needed to~~ of the  
 contact surface is to compensate for the  
 action of this secondary current.  
 When the ~~contact~~ <sup>circuit</sup> is broken there is no  
 route <sup>or circuit</sup> for the extra induced current to  
 set up an EMT to prolong the time of  
 demagnetization. If a very long magnet is  
 to be used the length of contact should be  
 still greater. ~~But of the resistance of the~~  
~~circuit is increase~~ The resistance of the  
 circuit <sup>upon</sup> which the magnet is  
 placed as well as ~~its~~ <sup>the</sup> length and number  
 of convolutions <sup>of the average</sup> has an important

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"Break Wheels." Another version in Edison's hand. (5 pages  
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effect<sup>4</sup> on the relative proportions ~~between~~<sup>of</sup> the Contact Surface & space, as well as the action of any considerable leakage on & between the battery and break & the electromagnet; ~~by short~~<sup>by shorting</sup> the longer the magnet & the lower the external resistance, the greater must be the contact surface and the less the space. (see chap on discharge in closed simple ckt)

Regarding the second objection it may be stated that the pressure of the contact point requisite to give 3000 perfect contacts per minute with a small number of elements within a circuit of low resistance is sufficient to wear off  $\frac{1}{10}$  of an inch<sup>4</sup> platinum wire to the of an inch in diameter  $\frac{1}{32}$  in 2 hours, on any rubbing surfaces ~~with the same~~<sup>intermittent circuit of low resistance + small battery</sup> to insure perfect contacts. The pressure must be increased directly with the speed, (i.e. with 1 cell of battery on an electromagnet or 1 ohm resistance if on a perfectly smooth wheel with a <sup>plain</sup> continuous surface with a contact point pressed against)

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If with a given power and <sup>the break wheel be</sup> turned at a  
 given speed, it will offer a certain  
 constant resistance, all others  
~~conditions being the same~~ over  
 If the speed of the wheel be doubled  
 The resistance will be doubled  
~~and it~~ constantly increasing with  
 the speed, so constant is this  
 resistance ~~thus by merely varying the speed~~  
~~of the resistance of the break wheel it can be increased or~~  
~~diminished by varying the speed~~  
 when the speed of the wheel is  
 even that it has been suggested  
 as a measure of resistance,

SEE about increasing element,  
 calling the Resistan  
 Measure of in Bridge or  
 — Bradley —

12)

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"Break Wheels." Another version in Edison's hand. (5 pages  
 with Batchelor's annotations).



16 Break wheel -

B is the vibrating lever provided with a double plainized foot, <sup>and is connected to earth</sup> and <sup>it</sup> and <sup>it</sup> are two points both connected to the line, F & G are two contact springs, connected to the ends of the battery. When the point on the lever B is in a space ~~on the wheel~~ is between the teeth on the wheel A. a zinc current flows to line, when the lever B is on a tooth, a Copper current flows to line. This is a very effective & simple device. Other forms may be made by using double wheels <sup>or contact points</sup> ~~Other forms may be made by double contact wheel and levers, but those already described~~

12)

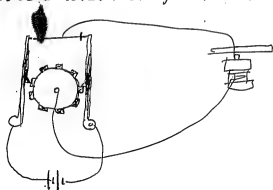
(12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12c)

Pages 16 (2 versions), 17, and 18 of (12a) or (12b). (4 pages; Edison's hand).

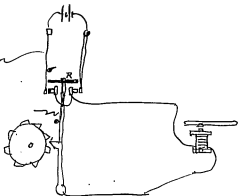
16 Break wheel

— Shows another plan



Describe,

Another plan



Describe.

27

12)

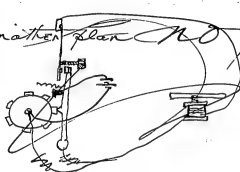
(12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

12c)

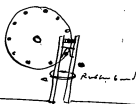
Pages 16 (2 versions), 17, and 18 of (12a) or (12b). (4 pages; Edison's hand).

- 17 Break wheel -

fig - shows another plan NO good



Add to Single Current break



describe,

for renewal with single point  
single battery see chapter



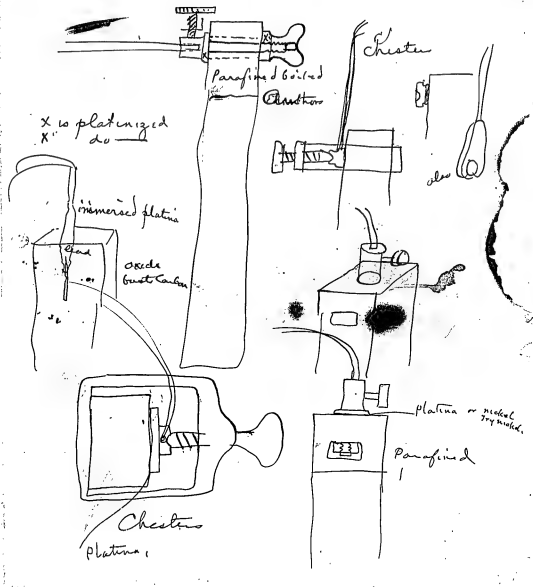
12)

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12c)

Pages 16 (2 versions), 17, and 18 of (12a) or (12b). (4 pages; Edison's hand).

~~18 Break Wheel~~  
1 connections for Carbons



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12c)

Pages 16 (2 versions), 17, and 18 of (12a) or (12b). (4 pages; Edison's hand).

number of perfect vibrations from an armature lever, the contact surface of the breakwheel tooth should have twice the surface of the break or space between.

The reason for this is obvious when we consider that upon closing a circuit in which there is an electromagnet, the secondary current from that magnet sets up an opposing electromotive force to that of the battery, which prevents the magnet from being charged immediately, hence the extra amount of contact surface is to compensate for this secondary current.

When the contact is broken there is no circuit for the extra induced current to set up an electromotive force & prolong the time of demagnetization. If a very long magnet is used the length of contact should be still greater.

The resistance of the circuit in which the magnet is placed as well as the length & number of convolutions of the magnet, has an important effect on the

12)

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12d)

Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

insulated wheel prevent the cleft from entering too deep into the space. As the wear on both contacts can be made nearly the same the length of contact remains unaltered.

Fig 4 shews another form:-

B is a smooth faced wheel the surface of which is covered with platinum to prevent excessive oxidization. A is a toothed wheel insulated from B; this wheel is provided with as many ~~contacts~~ teeth as there are contacts to be made in one revolution. C is the contact lever provided with an extra arm to be moved by break wheel. K

The movement given to the contact lever by the tail of A control the length of contact. The spaces between the teeth should be shallow & the 2 points should be so proportioned that when contact is being made the extra arm should not touch the bottom of space

Another form of breakwheel is shown in fig 5. The rubbing contact points shown on the breakwheels previously described is here replaced by a wheel A. The advantage obtained by using a wheel is that it will give a better contact & with the same pressure will have less friction, hence the pressure may be greatly increased in order to insure perfect contact. Another advantage is less wear of contact point. There are very important considerations with that class of apparatus which can spare but little power to rotate the breakwheel. The roller should be made as in fig 6. When rollers are used a small watch spring tipped with chamomise skin should press lightly against the periphery of the wheel to remove the oxide formed by the spark & to prevent dust & the oxide from being rolled onto the surface of the wheel & making imperfect connection.

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Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

8

Frequently 2 rollers or points of contact are used as in Fig 7. The object being to insure perfect contact, should one point fail.

Sometimes two contact points are connected as in fig 8 to lessen the spark which is very troublesome when short circuits & low resistance batteries are used. This method is very effective for that purpose lessening it at least two thirds. But increasing the liability to make bad contact. This however must be remedied by increased pressure on the rollers.

Where two rollers are used to insure perfect contact, the length of contact may be increased by simply moving one roller ahead of the other.

Another form of breakwheel is shown in fig 9. Instead of using a tooth wheel pins are set at regular distances in the face of a smooth wheel A. CB are contact bars prevented from touching each other by the stop pins ED. Each pin on face of wheel A makes connection between CB thereby

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9

Closing the circuit.

A much superior class of breakers to those already described consists in using a wheel (merely as a mechanical device for lifting a contact lever from a fixed contact point. Fig 10 shows the method usually adopted. The objections to this break are First. The oxide is accumulated at one point instead of being divided over a large number as is the case in the former breakwheels. Second. Shortening of the contacts as the platinum points are worn by oxidation. Third. The rebound of the lever after it has touched the point. Lever rebound when after striking a rigid point, this rebound gives double contact when only one contact is wanted (See ) Although this interruption is very small the induction current of an electromagnet is very sensitive to them (See )

The effect of this rebound may be entirely prevented by using a flexible spring as in Fig 11

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Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

Although the rebound of the lever C against the pin x takes place it is not sufficient to allow it to break contact with the spring S. The stop pins v + x are adjustable thus the length of contact can be regulated by the adjustment of these pins.

A method superior to the one in which the chance of an imperfect connection are lessened is shown in Fig. 12. The oxidation of one of the points being almost entirely prevented B is the vibrating lever on the end of which are two platinum points one a little longer than the other.

C D are two contact springs both connected together having points of the same length & pressing against the stop pins E F. The longer platinum point of the lever B takes all the spark as it is the last point of connection the shorter one leaving its spring before the longer one, is freed from oxidation caused by the spark. In practice when there is considerable spark

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Draft essay on breakwheels by Batchelor. (12 pages incomplete).

& the contact- are being made very rapid the longer point & its corresponding spring will make one contact in about five hundred when this is the case the spark comes of course on the shorter one. This of course causes oxidation but it will be a long time before it becomes so great as to cause an imperfect contact. After the longer point has become very dirty through long use, the contact- will still be perfect as the chances of both points missing at the same time are very small. As the length of contact shortens as the points oxidize it must be adjusted by the stop pins E F.

The most perfect break in a mechanical point of view is that shown in Fig 13.

This is especially applicable to high speeds. The contact- are made as in Fig 12. but the vibrating lever is made with 2 pivots <sup>between</sup> at one end <sup>between</sup> in which revolves a cam which is worked by gears as shown in figure. The length of contact in this case will shorten as the speed

12)

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12d)

Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

increases. As the cam or eccentric wheel working in the forked lever is to which as will readily be seen it gives a vibrating motion not depending on a spring but positive in its action.

Another form of positive motion break are shown in Fig 14 & 15

In Fig 14 the lever is vibrated by means of a groove in the side of wheel A in which the bowl on the end of contact lever runs.

- 12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

Parawheel for reversed currents  
with 2 batteries

A is a tooth wheel on which the levers  
B & C alternately make contact & <sup>are</sup> so  
placed that when one is on a tooth the  
other is in the space; as will be seen by  
the connection of the two batteries in fig 16  
when C makes contact a negative current flows  
when B makes contact a positive current is  
thrown to line. These break are liable to  
fade defect as single current breaks

Fig 17 shows another method

B is a tooth wheel giving motion to  
the vibrating lever C which carries two  
platinum points on its end. DE are  
contact springs which rest against the  
platinum points. By the rotation of wheel  
B the lever C makes connection with  
D & E alternately showing reverse currents to  
line

(11-2)

12)

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Batchelor's annotations on the Edison drafts.

12d)

Draft essay on breakwheels by Batchelor. (12 pages;  
incomplete).

14

Breakwheel for reversed currents with  
one Battery. Fig 18 shows a plan.

A is a tooth wheel which vibrates two  
contact levers C & B one of which is on a tooth  
when the other is in a space. Thus: when  
C is on a tooth the point E is not in contact  
& B being in space point D will send a current  
to line, & when B is on a tooth & C in space  
contact made at E will send a reverse current

Fig 19 shows another method:—

In this plan F & G are 2 contact springs  
one connected to each end of a battery &  
resting against the contact pieces B & D. The  
vibrating lever B carries a cross arm C on its  
end which when it vibrates disconnects  
F & G alternately from their respective contact  
pieces throwing reverse currents to line. 115 (2)

12)

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Batchelor's annotations on the Edison drafts.

12d)

Draft essay on breakwheels by Batchelor. (12 pages;  
incomplete).

Another form of breakwheel for this purpose is shown in fig 20

A & B are two toothed wheels insulated from each other & their spaces filled in with vulcanite or ivory. 1 2 3 & 4 are contact rollers, 5 & 6 are also contact rollers which have to make a permanent contact one with each wheel. The rollers 1, 2, 3, & 4, are so arranged that one on each wheel makes contact whilst one on each is on the insulated part. Thus in fig 20 the roller making contact on their perspective wheels the circuit is closed through roller 3 6 5 & 1 & when 2 & 4 are making contact it is closed through 2 5 6 & 4.

In making this break care must be taken to have the insulated part a little larger than the tooth.

12)

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12d)

Draft essay on breakwheels by Batchelor. (12 pages; incomplete).

34 R of Galvanometer,  
Constant in R box-

$$\begin{array}{r} 10,000 \\ 10,000 \end{array} \Bigg| 20,000$$

Galv.  
Shunt



$$\begin{array}{r} 10,000 \\ 10,000 \end{array} \Bigg| 10$$

10 to 10 or 10 ohms which  
subtracted from  
10,000  
10  
990

$$\begin{array}{r} 2500 \\ 100 \\ 4 \\ 96 \end{array}$$

$$\begin{array}{r} 10,000 \\ 10,000 \end{array}$$

$$\begin{array}{r} 10,000 \\ 5,000 \\ 12,500 \\ 6,250 \end{array}$$

12,500.

3750

$$\begin{array}{r} 10,000 \\ 2,500 \\ 6,250 \\ 18,750 \end{array}$$

12)

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12d)

Draft essay on breakwheels by Batchelor. (12 pages; incomplete).



16

Another break for this purpose is shown in fig 21

Fig 21 is a vibrating lever having its ends insulated from its centre, & which is put in motion by a tooth wheel A. 1 2 3 & 4 are contact springs connected to battery as in Fig 21. The two points of vibrating lever are connected to sounder a line. By looking at the figure it will readily be seen that when the lever is on the tooth of a wheel the battery is connected with the sounder through springs 1 & 4 & when it is <sup>in</sup> the space, it is connected through springs 2 & 3 thus using reverse current.

108 (1)

12)

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12d)

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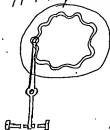
In this fig the pin is made adjustable by being placed eccentric in the end of shaft

Fig 7.

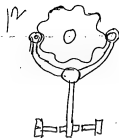


The length of contact can be increased in this breakwheel by loosening set screw a, b, & moving out a little forward.

11 Fig.



This is a positive motion breakwheel a good one where we have plenty of power, it causes considerable friction



Another positive motion breakwheel

Too much friction principal defect.

12)

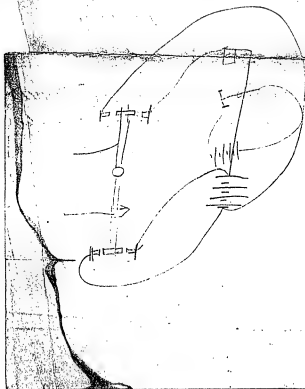
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12e)

Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).

24- E 1687

Transatl. Vol. 14, 'old Stateline 1877-1879  
(telephone)



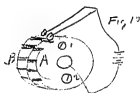
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to be put in  $\frac{1}{2}$  way down.



By making the wheel as in Fig. 10 and the supports <sup>A</sup>13 screwed together by means of the length of contact can be adjusted by simply setting one a little ahead of the other.

This can also be done by setting one <sup>ahead of other</sup> from the form of breakwheel.



as described is shown in Fig. 11. It is a wheel cupped in the form of a <sup>cup</sup> with a screw on one end & a wheel & T on the other end contact points to close on points E-P.



F

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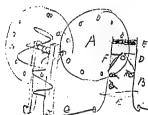
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12e)

Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).

Another form of Breakwheel is shown  
in following fig. A is wheel ~~on side of which~~  
~~are pins are set~~ ~~on which form~~



are set in side material of both  
in face. C B are 2 contact springs  
held apart by insulated pins <sup>#</sup> E  
H D as the 2 contact points  
which are ~~kept apart~~ ~~held~~ ~~kept~~  
each other by the stop pins E. Thus as wheel  
rotates each pin ~~in~~ comes in contact with the  
Contact points at D<sup>F</sup> making through circuit  
from # to C.

[3]

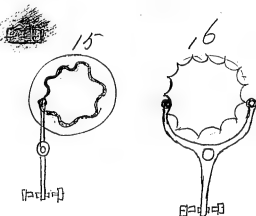
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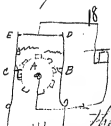
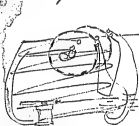
12e)


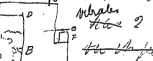
Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).

124



Break sheets for reversed currents with Hattery  
Fry shows one place

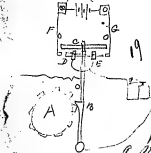


A is a barbed wheel about  
 1/2 inch thick 2 contact wires C & B  
 the 1st wire is one of which  
 is actually on a bolt when  
 the other is in a position - the  
 support E is not a contact of B being a  
 contact of D with a curved line of wire B is a contact of a fine contact  
 D is a contact of a fine contact of a fine contact of a fine contact  
 F only and reverse current  
 a tooth C is in a space & contact E is on a live  
 to line

E & D

Fig. show north plan

[illegible]

of contact persons E & D

shopper  
500  
ready age

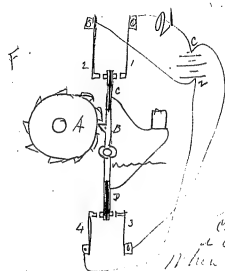
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- 12)

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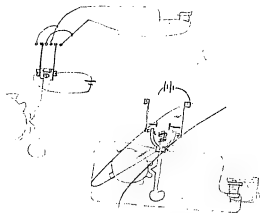
- 12e)

Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).



Another method of reversing current on single battery is shown in A is a ~~rotary~~ wheel by which the lever B is moved 1 2 3 4 are contact spring points both of lever B is in space of wheel the lever comes in contact with contact points 2 & 3 showing a current through sounder

When the lever is on top of both springs 1 & 2 are connected through in opposite current through sounder, the ends of lever B are insulated from each other



663

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12e)

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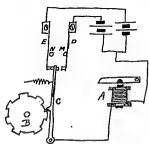


Fig 17

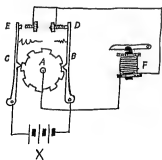


Fig 18

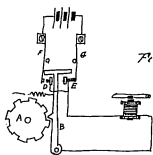


Fig 19.

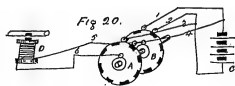


Fig 20.

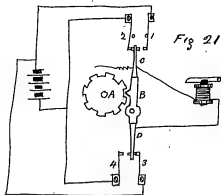
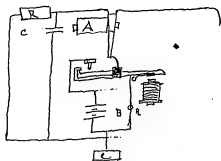


Fig 21

[7]

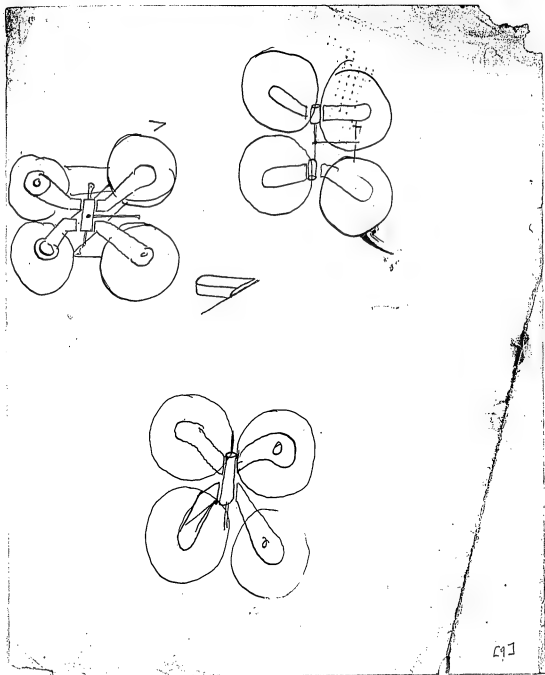
- 12) (12a) - (12e) appear to be related. These drafts all concern breakwheels and are by Edison and Charles Batchelor, with Batchelor's annotations on the Edison drafts.

- 12e) Illustrations for essays on breakwheels. (9 pages; Batchelor's hand; one may be by Edison).



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## Electromagnets.

(1873)?

It has been said and  
in this country, by persons  
who profess to understand the  
laws of Electricity and magnetism  
about the proper dimensions and  
resistance of ~~the magnet used~~  
relays <sup>under given conditions</sup> to produce the best results.  
~~These pseudo Block Electricians~~  
~~abuse this and that telegraph~~  
~~functions without stint for~~  
~~themselves. They criticize all the Ohm~~  
~~law down Ohm's Law as <sup>an</sup> ~~to~~ one to six~~  
~~if followed in the proportion~~  
~~of the relays in a circuit.~~  
~~When in fact to obtain the~~  
~~best result without special~~  
~~apparatus Ohm's Law the further~~  
~~we get from the <sup>more</sup> we approach~~  
~~the resistance of the relays~~  
~~upon ordinary Commercial~~  
~~lines to that law the~~

the result.  
~~extra speaking~~ In nearly all instances it is not a want of power in the magnet that produces bad signals, it is the self induction of the magnets themselves which modulate them.

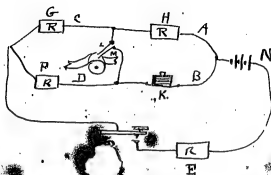
But the modulation of signals which follow ~~there~~ is produced by the relays themselves by self induction in conjunction with the static induction of the line ~~case~~ make the proposition of resolvers to obtain the greatest effective power as of secondary matter, the main importance, The main point to ~~it is well known~~ be taken into consideration in the proposition of relays to currents is their self induction -

It is well known that the author employs the discharge from an Electro. Magnet to compensate for the static charge of the line in his Automatic System. Owing to the liberality of his associates, interested in that system he was enabled to make an immense number of experiments on the inductive action of Electro-magnets in every form and shape.

The instrument used was a Wheatstone bridge parallelogram in the bridge wire of which was a very sensitive chemically recording instrument moved by clockwork running at a regular speed.

The magnet <sup>4</sup> ~~was to be inverted~~  
~~tested was placed~~ The resulting  
 on the chemical paper were two  
 recording pens one of which  
 gave a mark by a current in one  
 direction while the other pen  
 gave a mark from a current in  
 the opposite direction.

The magnet or ~~device~~ apparatus  
 that was supposed to give  
 induction effect was placed  
 in one of the bridge wires  
 and its resistance balanced  
 by resistance coils. This  
 apparatus is shown in figure.



The laws which govern the charge and discharge of the iron core of an electro magnet are nearly the same as those which govern the charge and discharge of a long insulated conductor, Both are due to <sup>most</sup> all the phenomena in both cases are due to the ~~induced~~ <sup>induction</sup> production of induction currents, <sup>which are governed by certain conditions</sup> by the original ~~to~~ Dynames Current.

One of the laws of electromagnets is that the charge and discharge is in proportion to the length of the iron core. The why and wherefore of this the cause etc I have been unable to glean from any investigations heretofore published that have come to my notice.

~~It~~ I was led from this want of data to undertake a series of investigations with the view of learning if possible ~~some~~ the causes of some of the phenomena if not the noticed by different investigators.



(1874)  
Telegraph

and described in works upon the subject.  
Electricity and Magnetism.

The part which the secondary or induction current performs in ~~electro magnet~~ <sup>operation</sup> are very complex and are undoubtedly the cause of the anomalous results obtained by some experimenters.

My first experiment was with an ordinary magnet  $1\frac{1}{2}$  inches <sup>English</sup> long wound with insulated copper wire the resistance being 124 ohms. This magnet was provided with a lever & armature and in fact was the same as a Relay used upon the American telegraph lines.

This was placed in a short circuit containing 10 cups of Bunsen battery and an adjustable rheostat, ~~its range~~ Each coil of which was 30 ohms and 30 coils

The operator at the distant station to balance his outgoing current upon his receiving instruments with out interference from the current from V.W.

C is the receiving apparatus and is the same as  $CB = C$  described in the Duplex Apparatus.

③

F is a second transmitting magnet & lens operated by a local current local Battery B<sup>4</sup> & key V.

When the key V is open the lens of F is drawn away from the magnet

If no message is transmitted  
 of now <sup>as with</sup> the operator ~~button~~  
 with the key ~~U~~ the  
 Class, the key U the  
 battery W of 150 cells  
 is thrown in circuit and  
 the coil L<sup>8</sup> thrown out  
 of circuit. (the preserving  
 resistance equal) and  
 the total battery power  
 is augmented to 200 cells  
 this passing to the  
 distant station is of  
 sufficient power to close  
 the relay M at that  
 station and if now the  
 key U be held closed the  
 whole 200 cells is  
 constantly renewed by  
 the operator working  
 the key S. These

14  
effect in the tongue of  
the polarized relay  
Were the permanent magnet  
of the polarized relay  
three times greater than  
the magnet produced  
by the current from the  
battery, V. the addition  
of the 150 coils would  
increase the force with  
which the tongue was  
thrown from right to  
left or left to right  
and although the  
signals would still  
be recorded on a  
Morse when they  
would to the ear of  
a "dumb" operator  
under the same

[illegible]

used two at one <sup>21</sup> end of the line  
and two at the other end, (1876)

Two of these relays are of the  
ordinary character and respond  
to currents of a certain strength  
independent of their direction which  
they flow, while the other two  
relays respond only to a change in  
the direction of the current and  
independent of its strength,

A magnet of each kind is placed  
~~at each station~~ <sup>say both N.Y. & Wash.</sup> and  
~~both are~~ arranged with extra magnets

that the passing transmission of  
a battery a weak or strong battery  
current over the wire from N.Y. to  
~~dist. station~~ <sup>Wash.</sup> through the  
magnets ~~at the station~~ <sup>at N.Y.</sup> ~~where~~  
~~the battery is placed~~ has  
no effect upon them, ~~second~~  
~~batteries and extra magnets exactly~~  
~~belonging the effect of change of~~  
~~of the battery current through~~  
~~Chenier's relays placed~~  
~~being, but of the current acts~~  
upon the ordinary relays  
magnet at ~~the dist. station~~

and a signal is transmitted,  
if now the direction of the current  
be reversed <sup>at NY</sup>, the other magnet <sup>at Wash</sup> responds  
and another distinct  
signal is transmitted, ~~at the~~  
~~same time the distant station~~  
~~can transmit strong &~~  
~~reverse currents and change~~  
~~the direction of the flow~~  
to effect

While these two distinct  
signals are being sent from  
NY to Wash, the latter  
may in the same manner  
transmit two distinct signals  
to NY. ~~Although~~ the  
action of the currents in the  
line connected is very  
complicated yet no two  
currents pass each other  
in opposite directions, <sup>at the same time</sup> although  
this is disputed by some  
Electricians,

23  
Mr. Edison, whose active brain has  
brought all this about, is not yet  
thirty years old. But for the  
last six or eight years his name  
has been well known in the telegraph  
world. His many inventions  
of both instruments & systems  
has done much to simplify  
cheapen and advance telegraphy

---



## Edison's Inductorium.

This coil has been designed especially for family use, ~~the~~ The principle of the induction coil was first discovered by the celebrated Experimental Philosopher Faraday <sup>in</sup> and the first coils were constructed by Ruhmkorff an ingenious French Mechanician and by Prof. Page an American, <sup>in</sup> since But little improvement in their form has been made since that time with the exception that machines of greater power have been constructed. ~~In~~ the Royal

Polytechnic Institution of London<sup>2</sup>  
has an immense induction coil  
~~some 11~~ the wire bobbin of  
which is about — feet in  
length and — feet in  
diameter, which gives  
an ~~and~~ electric spark of 2  
feet in length.

In the Stevens Institute of  
Technology at Hoboken is  
another very powerful induction  
coil constructed for that  
institution by Ritchie of  
Boston Mass. which is exceedingly  
powerful considering

its size when compared to  
~~the~~ its English prototype  
in the Polytechnic Institution  
Prof. Morton has succeeded in  
making the spark  
penetrating through a solid  
block of glass 4 inches  
square ~~with~~ the course  
of the spark being beautifully  
shown by the fracture, in the  
line of the path. The induction  
Coil in the hands of the hands  
of the Scientist has proved  
+ is proving  
a powerful instrument of  
investigation. - But it was  
not long after the introduction  
of the induction coil before  
it was discovered that

the transmission<sup>4</sup> of the  
Electricity generated by it  
had a power through the  
different parts of the human  
body ~~had a powerful effect~~  
had a <sup>powerful</sup> tendency to overcome  
certain obstinate diseases  
which when all other means  
had failed, for instance  
Chronic Rheumatism, ~~in the~~  
for Late years a special branch  
of medical practitioners have  
sprung up whose rely solely  
upon Inductive Electricity as  
a ~~new~~ remedy and many  
valuable facts have be observed  
many of which have been

power of the Cell is greatly  
lessened, the effort has until  
~~now proved unsuccessful~~

The lowest priced coil now sold  
and the want of a clean-  
powerful & economical battery  
which should be of a lasting  
character, the effort has  
until now proved unsuccessful

The lowest priced coil having  
lowest price which a  
coil of like power & workmanship  
can be purchased in this  
country is twenty five dollars  
and even at this price, owing  
to facts mentioned above  
very little profit accrues  
to the makers;

(1879)  
The cheapest coil sold Cast  
tincture dollars but the  
current from it is comparably  
feeble,

This induction coil is wound with  
many turns of a four strand  
fine <sup>enamelated</sup> iron wire, ~~instead of copper~~  
~~wire used in these in all previous~~  
~~coils. The reason for this is much~~  
~~less it is in the point of quality~~  
it is in place of a single wire  
of copper. ~~then the~~ By using  
iron wire the whole coil  
becomes magnetic and sets up  
an extra induction current  
which is at the case with  
the coil wound with copper  
There res

8  
The coils are then boiled for several hours in specially prepared paraffine to thoroughly insulate each convolution from its neighbor and prevent loss of power.

The workmanship ~~on the~~ apparatus is fully equal to that given by the best philosophical instrument makers, and unlike that of most cheap coils now sold, which are made without regard to beauty or lasting qualities, the battery accompanying this coil is a Bunsen Bichromate of palatish battery complete, and the same as used by the telegraph Co.

9

with the exception that the zinc of this battery is chemically pure and will last twice as long as the ordinary zinc universally used besides giving a stronger current and evolving no hydrogen.

It is the most powerful battery known and it may be used for other purposes than in connection with the Coil - When connected to a small Electromagnet it will cause it to sustain several pounds of iron in contact with the Core.

Among the uses to which the battery can be put to may be mentioned, Electroplating with silver and copper etc.



working ~~like~~ Magnet telegraph  
 instrument, for short lines of  
 telegraph for ringing electric  
 bells, for decomposing water into  
 Oxygen & Hydrogen Gas,  
 twenty Cells will produce an  
 incandescence Electric Light between  
~~Lead & zinc plates~~ Carbon points,  
 & three Cells will heat fine platinum  
 wire red hot, = and innumerable  
 other uses, The power of the  
 Coil may be greatly increased  
 beyond human endurance by  
 adding two to four cells  
 instead of one, although it  
 is seldom that a person can  
 stand one half of the current  
 generated from the six cells

The following are the specific  
diseases which it is known  
to cure, although it is maintained  
by many & many works on  
medical electricity that it  
produces good effects in  
many diseases not mentioned.  
first of all & for which it  
is the best and only remedy  
is Rheumatism,  
add here diseases



By pulling the regulating  
rod just out of the end of  
the coil a knife may be  
magnetized by pressing  
it on the tin part of the  
rod & passing it back  
& forward  $\frac{1}{2}$  an inch -

It may be made to act as  
a burglar alarm by attaching  
<sup>two</sup> plates of tin one the  
window sill and connecting  
the halves of door knobs  
and allowing the coil  
to vibrate all night -  
or by connecting a wire  
so that when a window  
is raised or a door opened  
it will close battery circuit  
& the handles being connected  
to a Cat she will give  
an unearthly & diabolical  
yell & wake all up.  
Patent applied for

If a current be sent in the course of the nerves  
connected with the vision or taste these sensations  
strongly excited - a flash light, a noise or metallic taste  
is often perceived. Wilson Philp  
Millencci observes - p 10.

The Induction Coil has <sup>late</sup> come into general favor  
it is used for ~~various~~ various purposes as a medical net, a  
means of scientific research ~~and an amuse-~~  
ment for ~~the~~ and an unfailing fount of  
Amusement, Chem news - ~~to~~

# Telegraph Journal

## England

To be rewritten

### On the Effect of Self Induction in decreasing the speed of polarized relays

The number of vibrations which can be obtained from a polarized magnet of a given length is controlled by the Circu Resistance of the circuit in which it is inserted, supposing there is no other interfering cause such as static induction etc. The greater the resistance of the circuit, the greater will be the number of vibrations of Lever-per minute, supposing of course that there is sufficient E.M.F. in the circuit to actuate the magnet. In other words if a polarized relay be inserted in a closed circuit of 200 ohms in which reversals are sent from a battery of sufficient force that the magnet of the relay will attract its tongue with a force of say 100. The number of vibrations will not be so great as when the relay is on 2000 ohms and the attractive <sup>force</sup> remaining the same, in fact if the resistance of the circuit is increased to 10000 ohms with an increase of battery power sufficient to give the magnet an attractive power of <sup>only</sup> 20 the speed number of vibration will be several times greater than on 200 ohms resistance & a battery power 5 times greater.

The reason for this is that when the relay magnet is inserted on a low resistance the electromotive force of the induction discharge is great owing to the low resistance of the circuit on which it is generated. This discharge which follows after one reversal in the same direction as that reversal must be neutralized by the next ~~reverse~~ current which is in a contrary direction. This of course lessens the number of vibrations per minute. If now we increase the resistance of the circuit to 2000 ohms or 10 times greater than in the first instance, and increase the battery power so that there shall be the same E.M.F. in the circuit as before the discharge from the relay is 10 less while the <sup>attraction</sup> power of the magnet is the same, as in this instance the flow of the discharge is checked to the extent of the extra resistance of the circuit in which it can flow or in other words the inductive discharge will be 9 times less from a relay on 2000 ohms with the same E.M.F. actuating it as upon 200 ohms. If we increase the resistance to 10,000, with no leakage to forms routes or

derived circuits where the discharge from the relay can flow the discharge is so much reduced that it scarcely <sup>weakens the primary current sufficient to</sup> impede the vibration of the tongue ~~even if the E.M.F. is~~ and the limits of speed may be obtained as far as regards the inductive currents from the relay.

From these facts it is obvious that ~~if it were not for the static induction of the line, it would be the greatest speed would be obtained from a polarized relay when several thousand ohms were inserted between the line and the relay as the resistance of the self discharging circuit formed of the wire & the combined leakage would be so great that it would have scarcely any effect upon it, when the leakage was very great. The discharge circuit which is the earth plate on one side & the leakage on the other is of so low a resistance that the speed of vibration is enormously decreased whereas by inserting a resistance between the relay & line the speed will in the same proportion be~~





The pressure of contact points  
 increase of speed must have  
 increased pressure. - Copper  
 better than platinum - Oil good  
 at first oxidized by sparks  
 dissolved in excess the oxide  
 (Black) which dries quickly  
 on stoppage few min & hardens  
 in places show Channel  
 records of a break wheel  
 at same pressure at different  
 speeds - see what increase  
 must be given for increase  
 of speed to get good record  
 .x

~~The content~~ occupying not  
more than 2 square inches of  
room & the adjustment made  
by a button extending upwards  
through the base

There are several other methods  
of attaining this object such as  
using an extra local coil  
on the magnet through which  
the equation takes place  
or with a double coil resistance  
& Earth wire. It is similar to  
the Duplex - In fact the  
Duplex attains this object  
though imperfectly the excess  
of current due to poor  
own battery not being used

the whole being equated for  
or rather balanced in the relay  
This may account for a fact  
mentioned by ~~the~~ the ops.  
that Duplex gives better signals  
on a very leaky wire than  
when worked ~~the~~ regular  
Morse =

Relay  
Escape neutralized

**1875. General (NS-75-001)**

This folder contains two documents. The first is by Charles Batchelor and is a list of possible inventions labeled "Wanted May 31 1875." A similar list can be found on page 2 of Cat. 1214, Account Series. Cost accounts for experiments related to these lists can be found on pages 60-126 of Cat. 1214.

The second document consists of 16 pages of notes and drawings by Edison relating to experiments on the electromotograph, some of which may concern the use of that device for telegraphy.

Wanted May 31 1895

- 1 A Method of making 'Malleable iron' out of cast iron
- 2 Making cast iron as hard as steel & to have some of the same properties
- 3 A method of making 'paraffin' soluble & form a cheap substitute for Ebony, hard rubber or Celluloid.
- 4 A cheap intense green equal to Amilind green without Iodine or Arsenic.
- 5 An Electrolysis which does not require water
- 6 The formation of organic substances for the decomposition of water under certain influences.
- 7 A Kerosene or other oil lamp which burns without chimney & gives a bright light
- 8 A new Engraving process

- 9 A Galvanic Battery of equal constancy & Durability but with an electromotive force equal or nearly equal to Grove.
- 10 A substance which will not pass or pass but little P. current & all of a N. current.
- 11 A New force for telegraphic communication.
- 12 Make soluble peroxidized paper with less acid than the Celluloid Co.
- 13 A Cheap process for the extraction of low grade ores, decomposed sand like either Carb. Ag. or H<sub>2</sub>S Ag. ores.
- 14 A Platina solution cheap & as delicate as Iodide of Potassium without drawbacks.
- 15 A Detector for Gold & Silver at a distance.
- 16 A Polarized Electrograph.
- 17 A Duplex Telegraph.

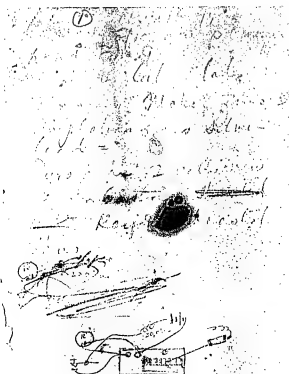
18. A copying press that will take 100 copies  
+ system

19. A Cheap process of printing news.

20.

21.

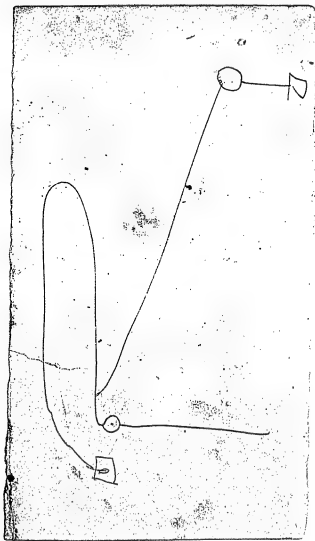




When all current  
passed through the  
paper it slipped  
on all metals with Hydrogen  
by decreasing Resistance  
of the R. so that a small  
friction went through probably

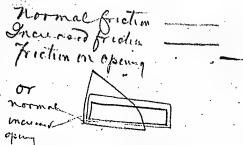
## 2. Discovery

1/4 all the metals except ~~tin~~  
tin showed an increase in  
friction on passing the current  
but tin still showed the  
slip, and by still further  
thinning the current  
the slip that had little  
passed through. Tin  
stopped slipping and  
increased its friction.  
Another notable  
thing was that when  
all metals except  
tin had an increased  
friction on the moment  
of closing the normal  
friction was increased  
say 10 degrees on opening  
the friction was increased  
to 30 deg but also not  
instantly subsiding, the  
instant the current began  
subsiding this friction  
was painful strong.



### 3 discovery

This friction may be represented like



I then tried a solution of Camille's patent but ~~was not~~ on account of a small current used it didn't show anything not being near as sensitive as pyro. I then put some salt NaCl in with the Camille's patent when I found that the strip for excitation delay the

### 4 discovery

Pyro - and gave an unexpected phenomenon;

No increase of friction could be noticed on closing but all metals after the current was very much weakened gave no results except zinc and this was very marked after all other even tin had ceased - and the slip was noticeable. This paper is the most valuable yet found & should be used on a zinc drum.

5 discovery

Have found that Silver  
is even better than zinc  
on a very low current  
though on an exceedingly  
fine current zinc may  
be better, Aluminum  
appears well on a fine  
current its all slip with  
strong momentary opening  
friction. Tried perfectly  
paper (10) wood paper  
and it appeared better  
than Common Bottom  
perhaps thick Wood  
paper will be better

6 discovery

I give zinc the preference  
off Silver with a low  
current on Wood paper  
etc,

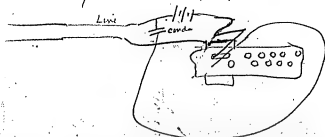
Platina is exceedingly bad  
gives very little work  
current on, tin meddling

Titanium slips 2-3 H<sub>2</sub>O  
but O very slightly -  
perhaps some other do but  
not noticeable =

We wet 2 rolls of  
Baum's R. & Nall  
stuck on EMU  
found that with sanding

7 discovery

Shunt 1500 ohm & the  
Condenser that we could  
by shunting EMF repeat  
slowly so it could be read  
though very ragged  
without shunt nothing,  
with this arrangement  
words could be read but  
they were somewhat ragged  
they is something in it



This weakens the first  
part of a dash &

8 discovery

leaves end full strength  
as the first portion of battery  
cannot has two route, the  
line & Condenser until Condenser  
is charged full current  
don't go on line. The  
second roller pair short circuit  
the Condenser through the  
discharging hole & prevents  
its charge going on the  
line,

With the palash <sup>rock</sup> paper  
highest speed straight  
<sup>21-22 gals</sup> that was ever obtained  
about 1200 wds a  
minute =

9.

my new line

With the new line the  
Evening we could get high  
speeds but the repeating  
Contact was very inferior  
for some reason. We had no  
spring on platinum points  
yet ~~but~~ I am under  
the impression that the  
old right-angle vibrator  
would do good repeating  
without a spring. ~~So~~  
We intend ~~if~~ putting  
on a spring on new line  
to test contact.

The line used with the  
Polack salt paper

10. discovery

was the old style =  
after getting 1200 words per  
minute straight (16) 15-0-0  
ahms & I hunted EMF  
with 100 & also with 1000  
ahms but could get nothing  
that was readable at 75-1  
words minute. This  
shows that some powerful  
secondary force action or  
alternance is circulating  
within the closed circuit  
which throws whole  
thing out of adjustment

11 Discovery

We have found that the  
thick wood paper used  
for perforating answers  
admirably for EMU  
it is more even & gives  
friction than rag paper  
used for counting =

We now 8:50 am are going  
to make various EMU  
solutions for test on  
hand EMU to endeavor  
to obtain a paper free  
from this Secondary  
phenomenon

12 Discovery

Sulphur Copper means friction  
on A. very painful  
when not skinned -  
When not skinned on C  
~~it increases friction~~  
when skinned it "slips"  
best on zinc.

Brookline K on A  
full slips slightly on C  
full friction great, vibrating  
skinned friction best on B  
slown, shorter shown also  
friction good on B slow

Sulphur K. Ralby  
on any except slight  
friction. Shows on B slow on A

13 Dec 1907

Tarapur Road nothing

Gravel sugar fraction

great on  $\text{O}$  = platinum & silver  
best,

Borax, for chlorine in acid

m.  $\text{O}$ . solution & silver

nothing on  $\text{H}$ ,

Carbonate in mix

unusable

14 Dec 1907

Hypocaphite Soda

nothing on  $\text{O}$  slips

on  $\text{H}$ . good both Platinum

& Silver. hardly perhaps

better = even when large

rows same

Get 2 cells, 75 ohms main

Key and Emf (hard mix)

checked with or without, 20 ohms

Decomposable, all Fe

nothing on  $\text{H}$

Hypoaliphite Soda & Soda

Chl Fe mixed nothing on  $\text{O}$

fraction in acid on  $\text{H}$ .

but nothing noticeable when separated



15-Discoy

Hypo. Na - desquich for NaCl  
makes black mark in platin  
with platin might be built  
up = no good in empty  
Tatare A + Grape Sug  
don't improve mark =

Sul Zinc slight slip  
in  $\odot$  friction considerable  
in  $\odot$ .

Umo. A slight (very)  
incus. friction in  $\odot$ .

Ordinary pyro acts  
one way & then another.

Inside 2 mins from some  
roll - ~~most~~ phenomena  
must be in platin  
absorbing gas. =

1875. Telegraph (NS-75-002)

Tracings follow other notes and drawings.

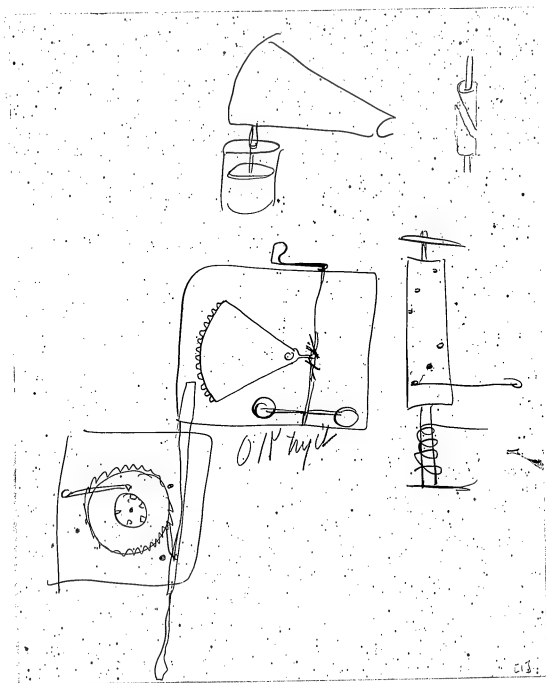
130  
20  
150

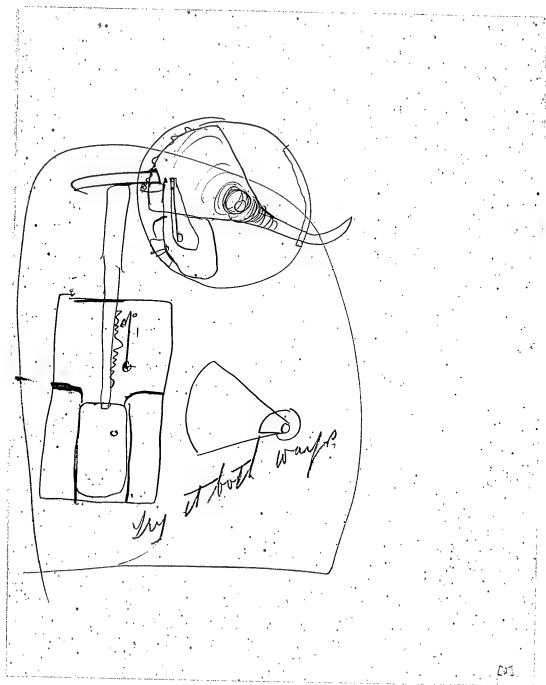
1500

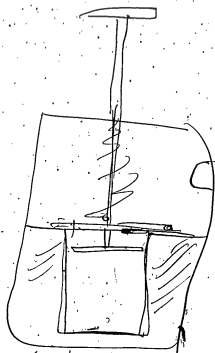
1500 Lines at 2 3000  
1 Recorder — 200  
1 Relay — 16

July 13 1875  
Domestic Telegraph  
Hotel Annunciator  
Experiments  
To be tried

Back as far as will; taken 15. A.P. v Domestic adj. to Apr 1875



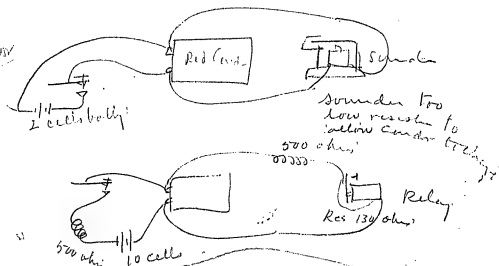




Old Lyck

Nov 2 1878 75

Edison  
Chapman



Apparently the Condenser  
needs a reverse charge  
this relay results the  
residual magnetism

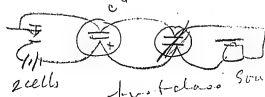
With a wetted Resistor,

pulling in Condenser ~~to~~

~~Red discharge~~ makes  
relay work sharp on an adjustment  
that the relay sticks ~~at~~ altogether  
(4c) about 2 sec after opening on  
during discharge with the 130 ohm  
resistor for relay discharge

Nov 21 1875

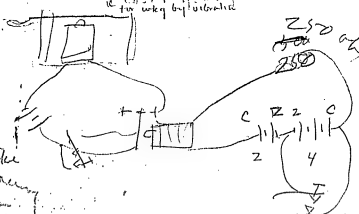
cells excluded in secondary battery X



first-class sounder  
 abts far apart keeps sounder  
 closed. the longer the dots  
 the greater the sounder keeps  
 it going for an accurate Telp  
 for wky by vibration

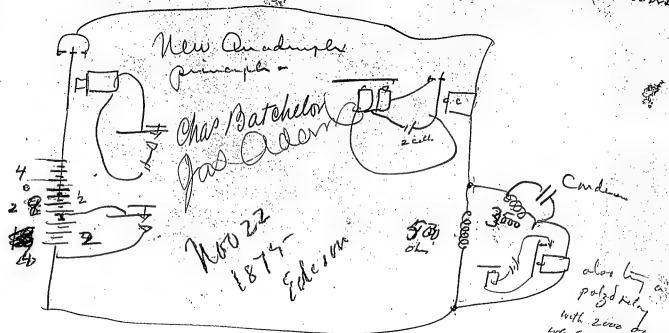
YH Edison  
 Chappato along

weight at x dent  
 work any well =  
 but on clay  
 Relay Key the jump  
 makes the down stroke  
 on the sounder & on opening  
 the other jump makes  
 the back stroke  
 the writing sound perfect & beautiful over but the  
 necessity of the sounder level touch the backpoint this depends  
 with the pole relay in the Alexander

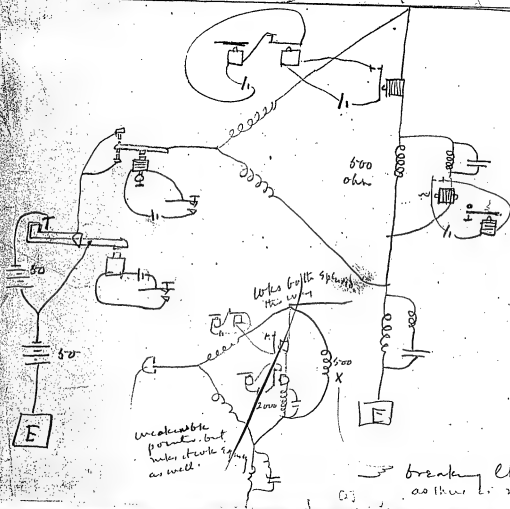




I think that if the back point relay had a second coil with a local & a coil so as to balance the permanent current it might work both though it might reverse a current & make it worse



with 1000 ohms in Condenser R not very good but better than if no R was used or Cond used, but when the made 3000, the dead open relay works perfectly splendid and the back point relay works better than when reversed currents are as. altogether the arrangement is a grand success



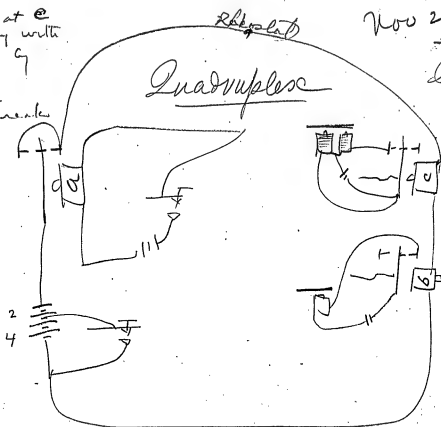
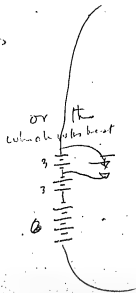
New Anaduplex principle =

Nov 22 1875 -

J. D. Edison  
Chas Batchelor

breaking chestnut X busts up dead open as there is no route for the Condenser

This is a front point relay with  
 total breaks designed by  
 Shunt relay also by  
 Shunt relay & use  
 of secondary battery but breaks  
 show loop plain & must  
 use break point relay

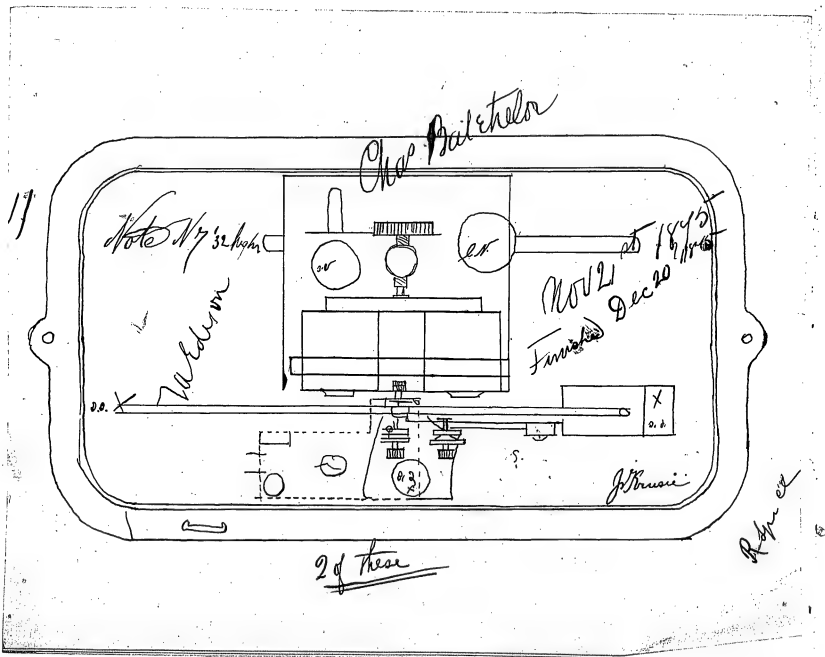


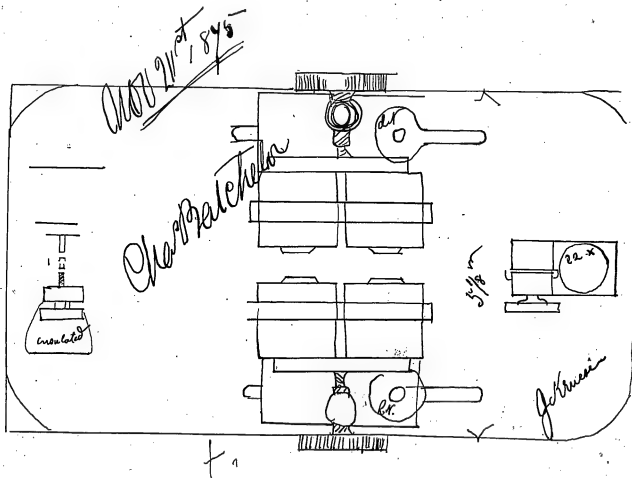
*Relay*

Nov 22 1875

*Tadison*  
*Charnalchelor*

This is a perfect if magnet of a  
 spring of a is so adjusted that  
 spring of a is so adjusted that  
 relay to open & close "each forward & back" in  
 number of times of a and all from a to  
 point into magnet, the total breaks go down  
 but when c is so far as necessary, showing  
 B with a center make it whole





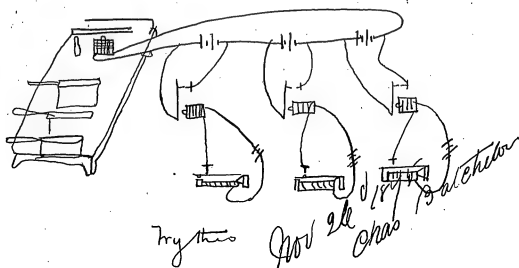
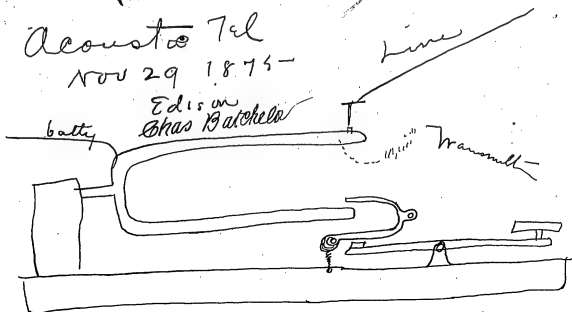


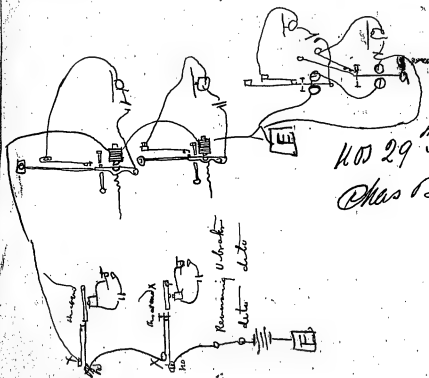
Exhibit D  
Case 116

Acoustic Tel

Nov 29 1875-

Edison  
Glas Bachelo





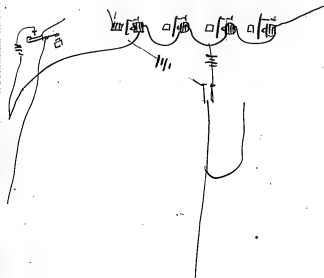
Nov 29<sup>th</sup> 1895  
Chas Batchelor

1876. General (NS-76-001)



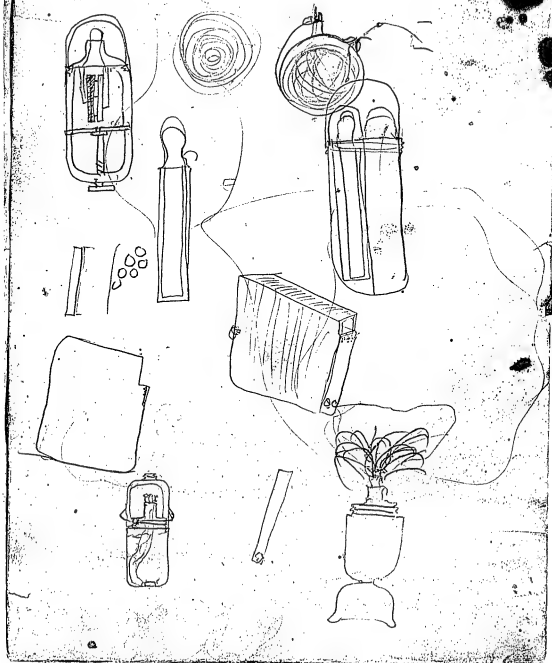
July 15 1876

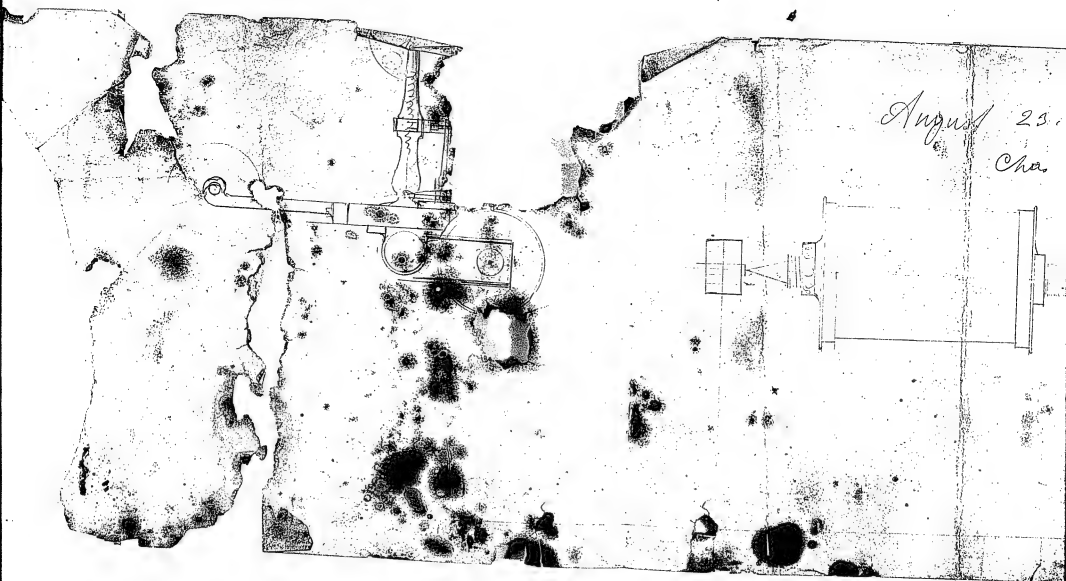
Tadousac



1876

Pocket lamp  
 Match box  
 Palage lamp of brass  
 Spectroscope  
 Microscope  
 Cryolite

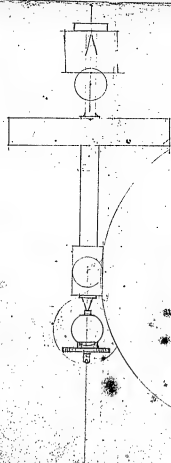
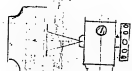




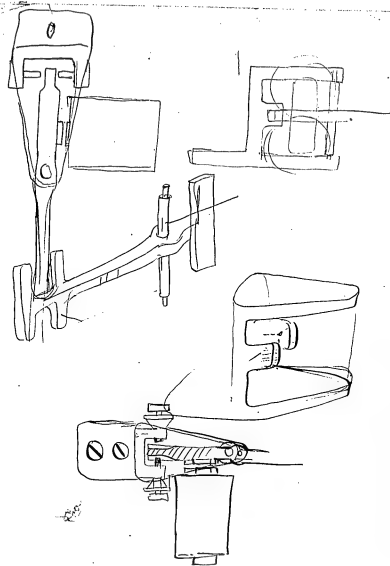
[CONTINUED ON THE NEXT FRAME]

August 23, 1926

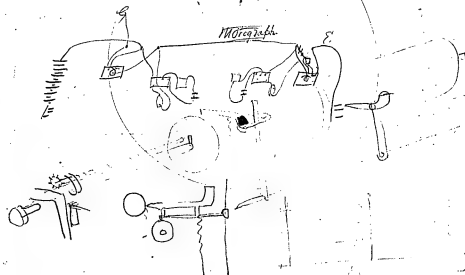
Cha. W. Bell



[CONTINUED FROM THE PRECEDING FRAME]

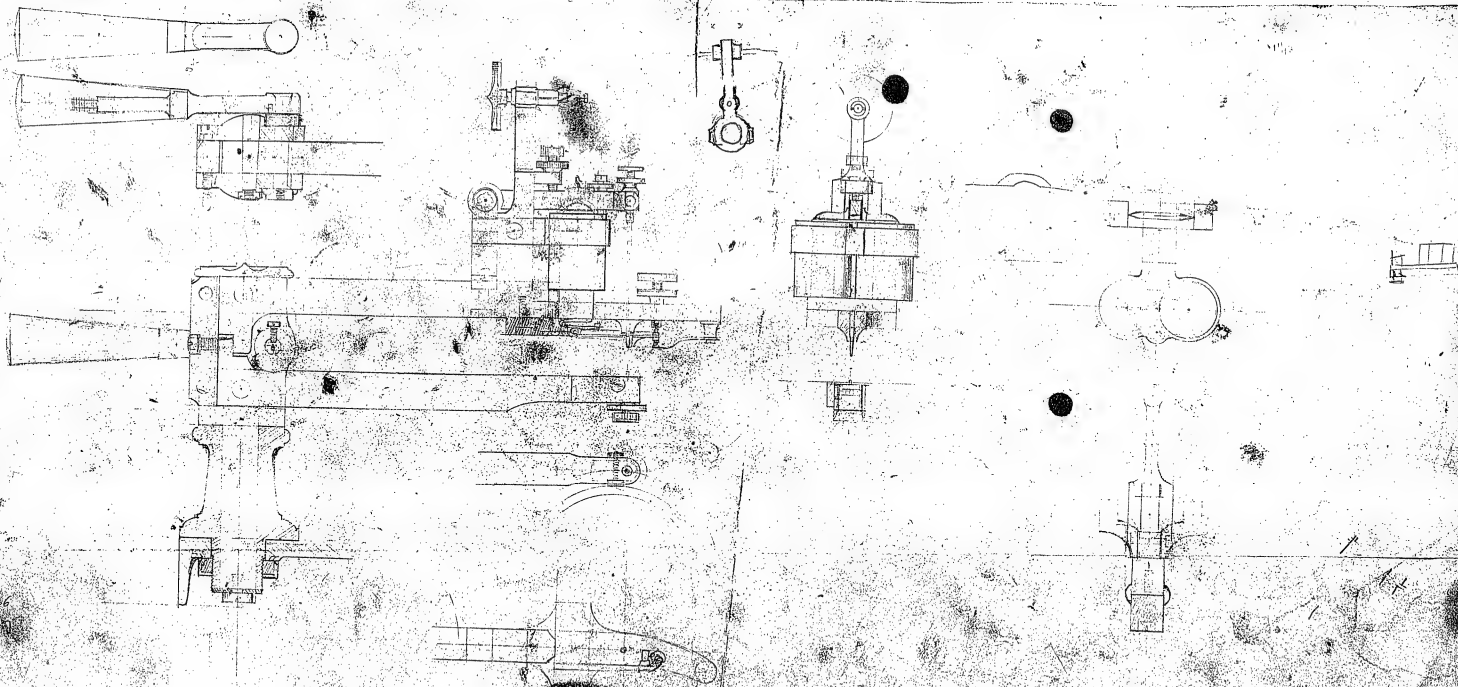


Oct 8<sup>th</sup> 1876



Nov 10 1876  
749

Copied Machine

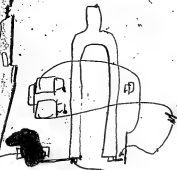


Dec 5, 1886  
Ch. E. B.

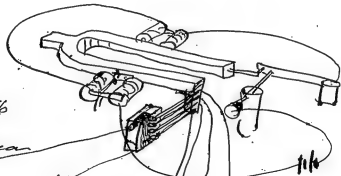
Patent

1876. Telegraph (NS-76-002)

Tracings follow other notes and drawings.

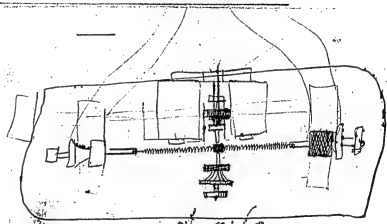


26  
Jy 26 1876  
Farman



James Adams

def no of contacts,  
Close by key 1 allow  
number of contacts such  
as of key 2  
quite 5. 100m  
if they can be ranged to transmit  
the several waves over the wire  
to effect the different parts or ends  
of the antenna



Monterey Jan 1<sup>st</sup> 1896  
Chas. B. Barche

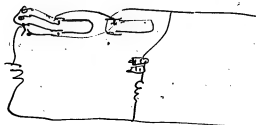


Receive without any battery

also do a reverse of one end of  
a circuit and receive with  
a polarized relay =

test the line through wires  
with battery used in transfer

Shunt to Earth with a magnet



Try the NY loop in place of  
the Washington loop —

~~Try using NY battery~~

July 10<sup>th</sup> 1898.

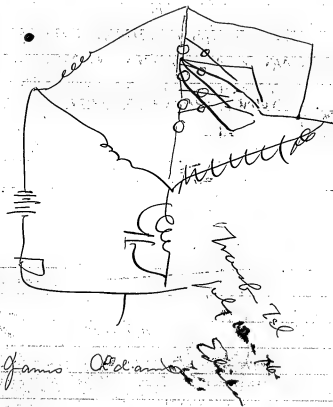
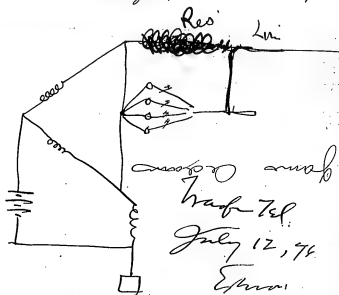
# Edison's Electrical Pen & Duplicating Press Co.



P. O. Box 5207.

41 DEY STREET,  
NEW YORK.  
MANUFACTORY:  
MENLO PARK, N. J.

New York, \_\_\_\_\_ 187



# Edison's Electrical Pen & Duplicating Press Co.



P. O. Box 3827.

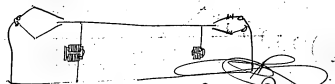
41 DEY STREET,

NEW YORK.

MANUFACTORY:

MENLO PARK, N. J.

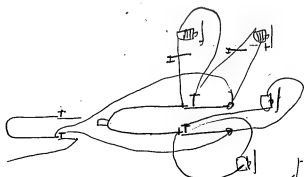
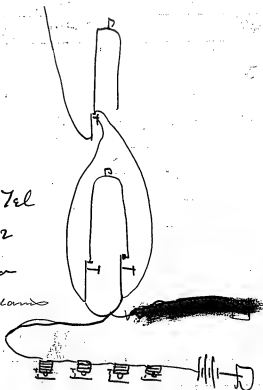
New York, \_\_\_\_\_ 187



Boston Boston Boston Boston  
Boston Boston Boston Boston  
Boston Boston Boston Boston  
Boston Boston Boston Boston



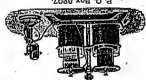
Trans Tel  
July 12  
Edison  
James Adams



Trans Tel  
July 12, 96  
Edison  
James Adams

187 ————— New York,

NEW YORK  
MANUFACTORY:  
NEW YORK  
41 DEY STREET,



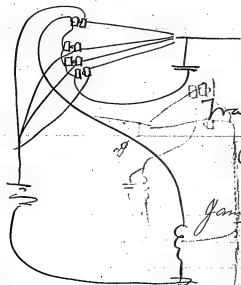
Edison's Electrical Bell & Telegraphing Apparatus Co.

187 ————— New York,

NEW YORK  
MANUFACTORY:  
NEW YORK  
41 DEY STREET,



Edison's Electrical Bell & Telegraphing Apparatus Co.



Frank Tel

July 12

Edwin

James Adams

Duplicating Press Co.

DEY STREET,

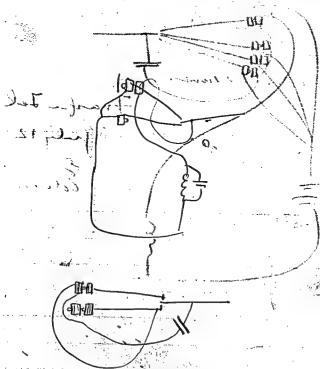
NEW YORK.

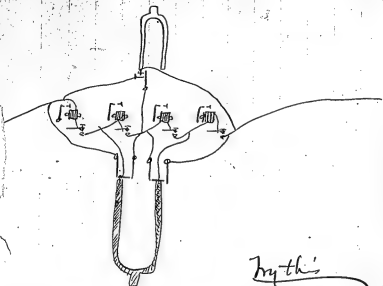
FACTORY:

10 PARK, N. J.

187

187



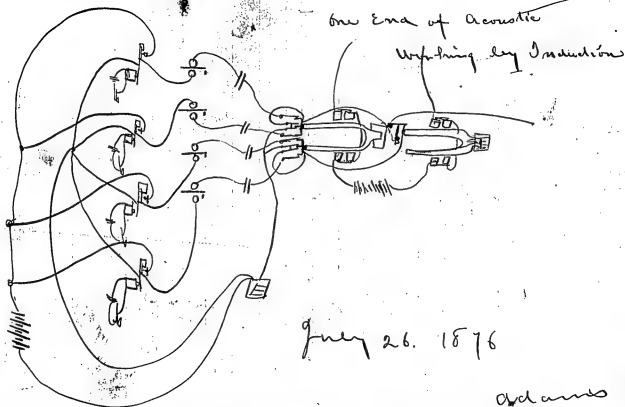
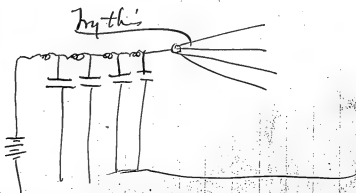


*Myth's*  
187

*Plan No. 2*

July 22 1876 -

*Jas*

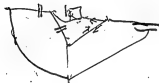
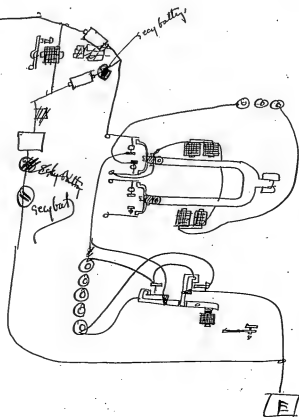


July 26. 1876

*adams*

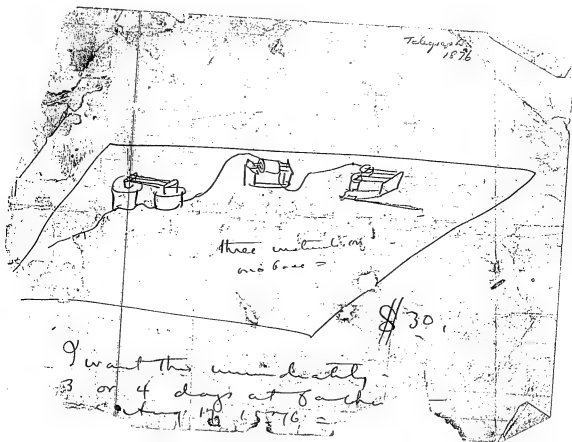
(Acoustic tele.)

Aug 7 1876.

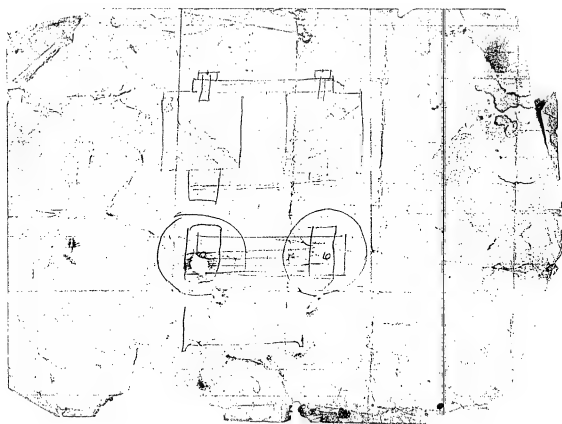




Telegraph  
1876

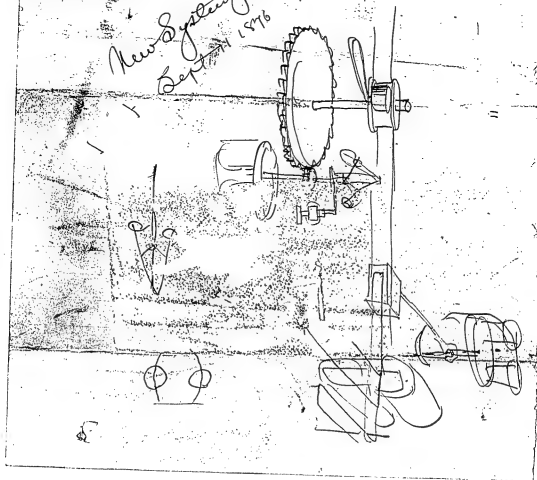


I want this immediately -  
3 or 4 days at 6 a.m.  
- 1876 =



*Secundo...*

*New System for a  
Sept 1896 T. Edison*



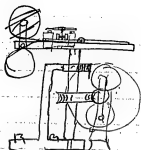
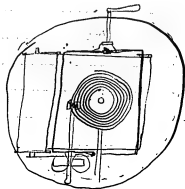
T. A. EPISON,

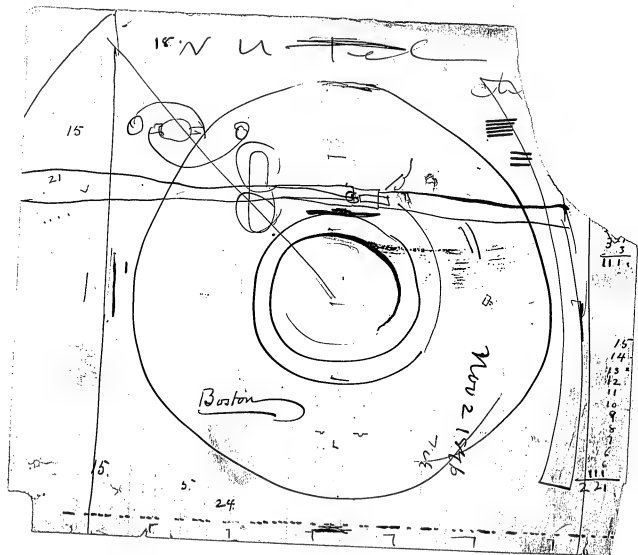
NEWARK, N. J.

10 & 12 Ward St.,

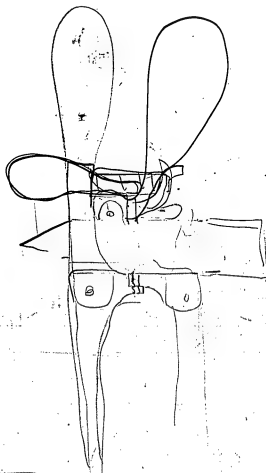
18

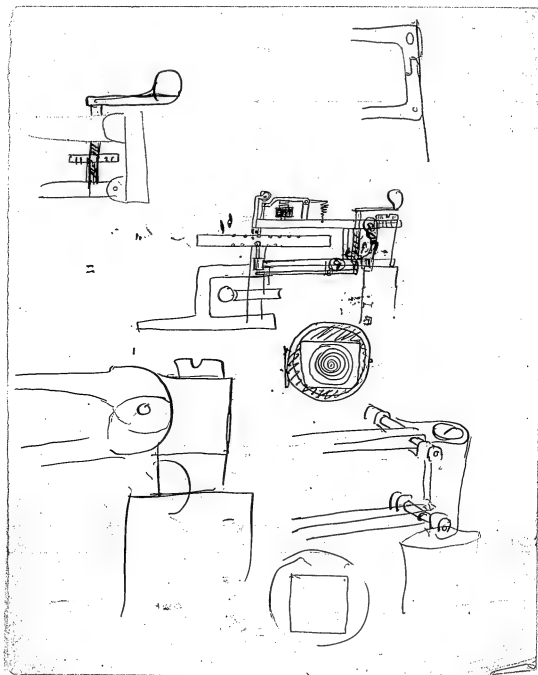
Nov 2 1876  
disk enclosure

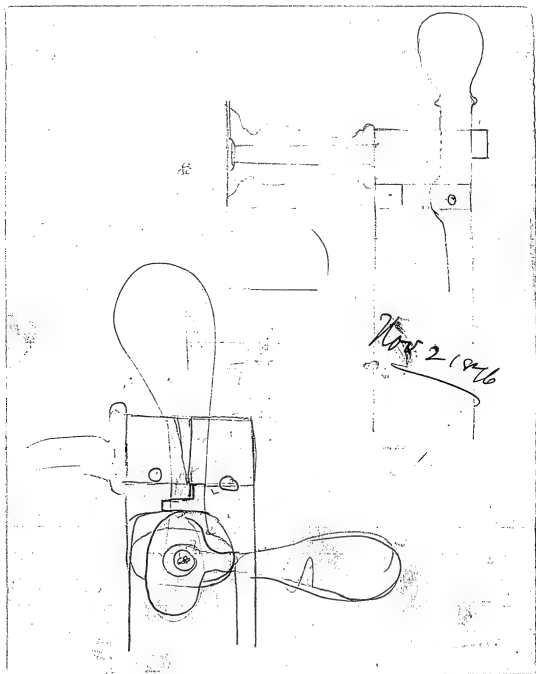




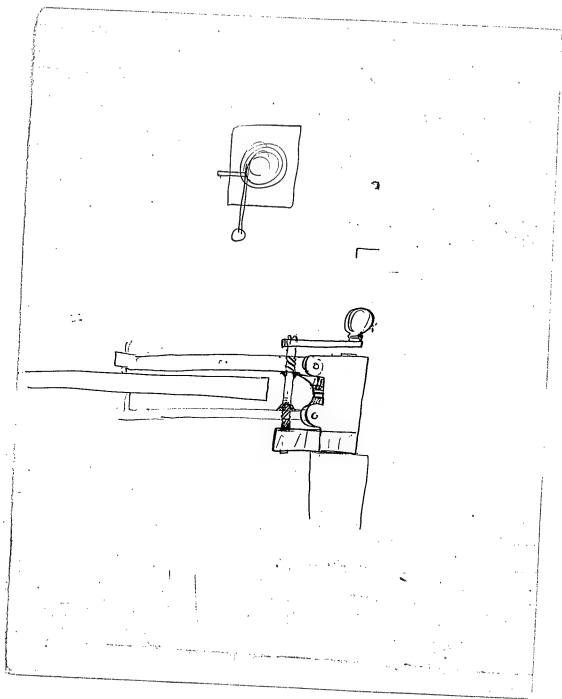
Nov 2 1876  
Tahara

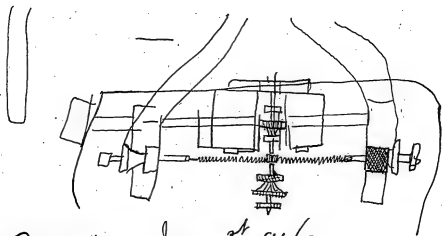






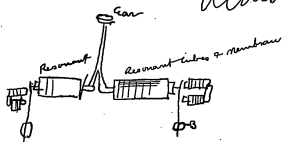






Acoustic Jan 1<sup>st</sup> 1896  
 Chas. Batchelor





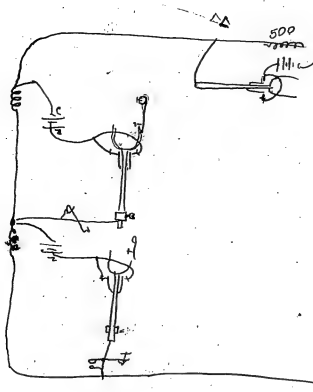
Admistrated

May 8 1876-

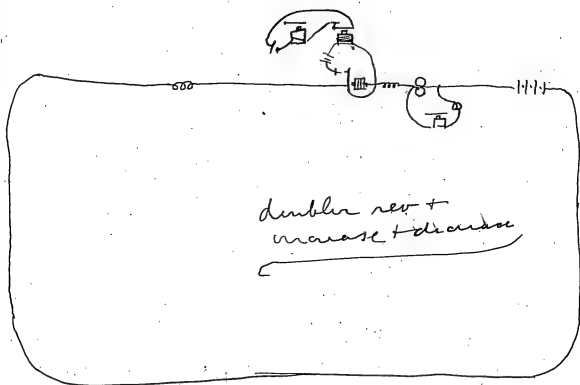
one need one note higher than other  
 1st part of dot sent on one need +  
 other part on other need -  
 thus giving up + down stroke  
 destructive causing the open to  
 read without trouble

Edison

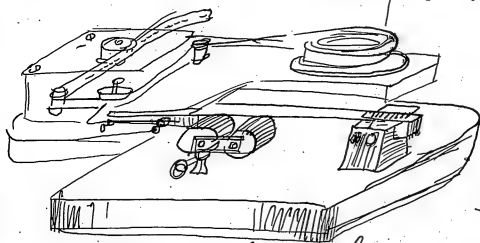
## TRACINGS



# TRACINGS



May 8 1876

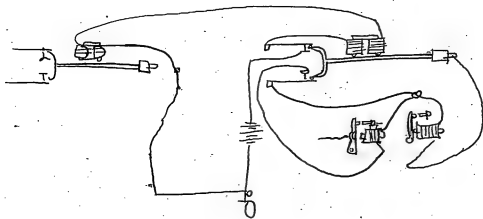


Edison

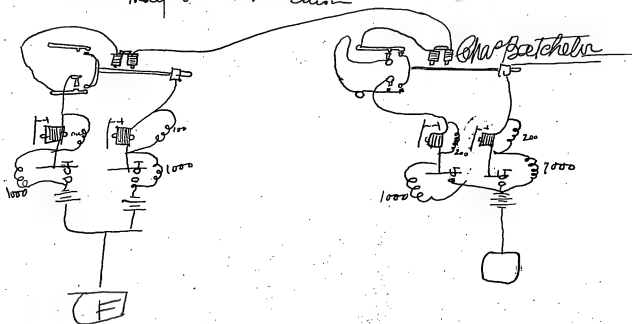
Acoustic Chemical

Recorder

TRACINGS

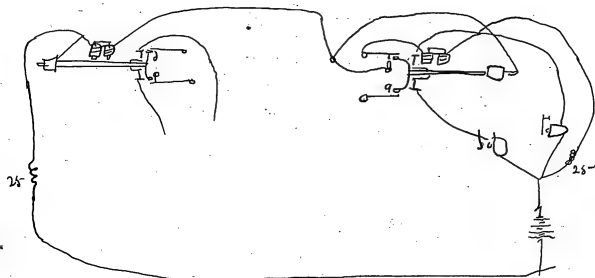


Keeping 1 line on two sets of instruments,  
May 8 1876. Edison

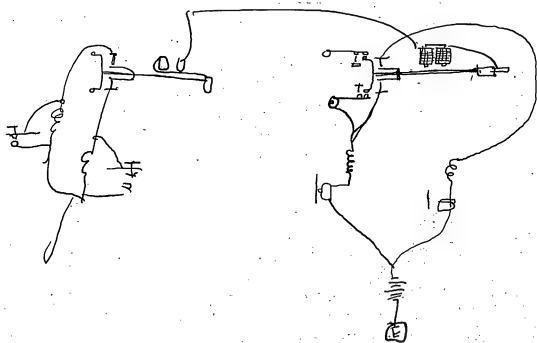




# TRACINGS



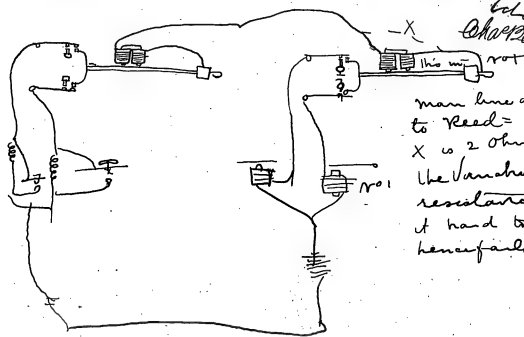
TRACINGS



# TRACINGS

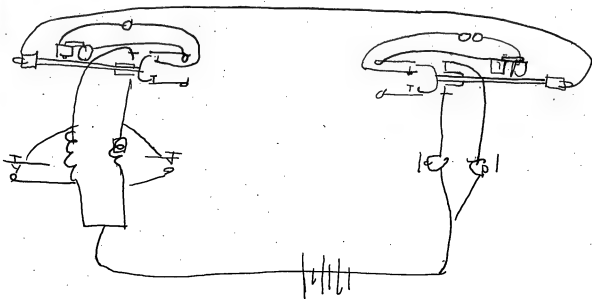
Q was at 1 May 8 1896

Edison  
Char. Patchen

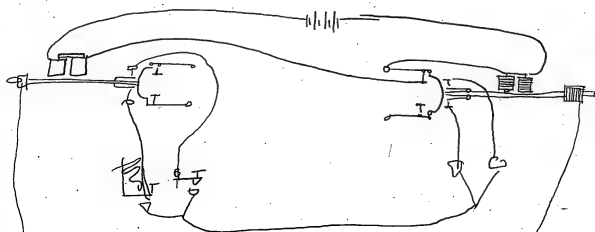


main line direct  
to Reed=  
X is 2 Ohm apool  
the Vanabur in  
resistance makes  
it hard to adjust  
hence failure

TRACINGS



# TRACINGS

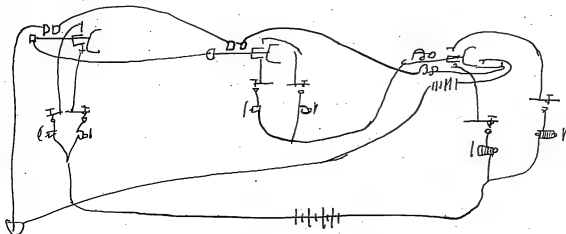


Works beautifully

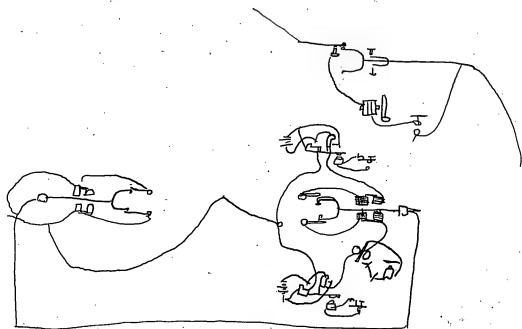
Apparatus whereby 1 wire with acoustic vibrator  
is made to throw another wire on two sets of  
wires at once ~~etc~~ making 2 complete wires of a single

one = for instance Gibby + Washin 1 wire  
can be the director with alternate Reeds  
this need can ~~be~~ make control as as  
to double 10 or 15 - more wires ~~is~~ both  
through 4 with way slates  
May 8th 1896 - Edison

*Same with a way station*

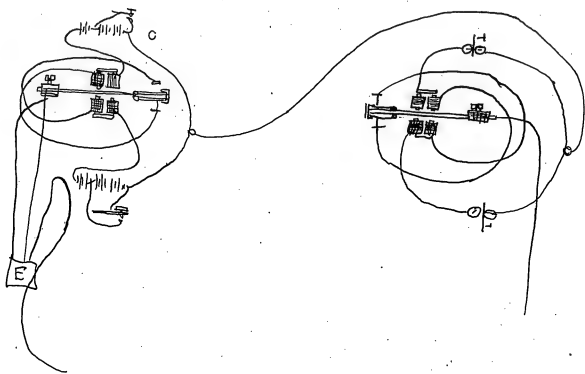


TRACINGS

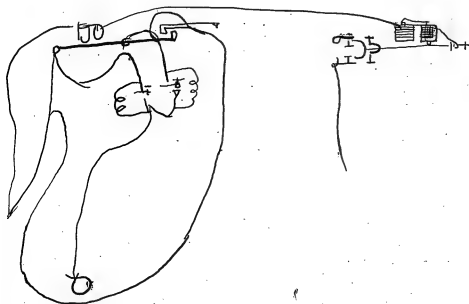




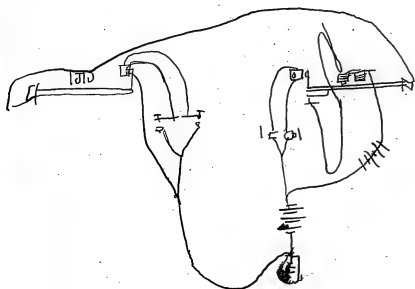
# TRACINGS



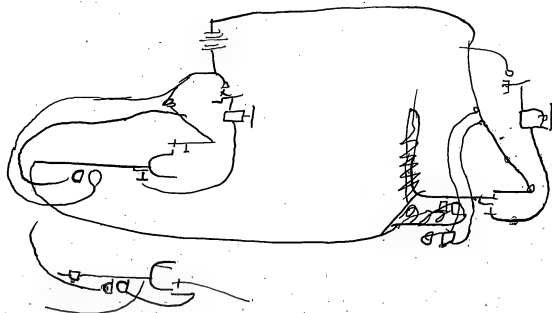
TRACINGS

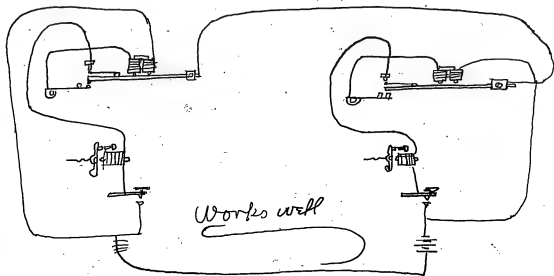


TRACINGS



TRACINGS



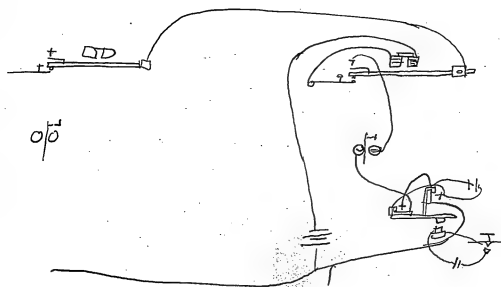


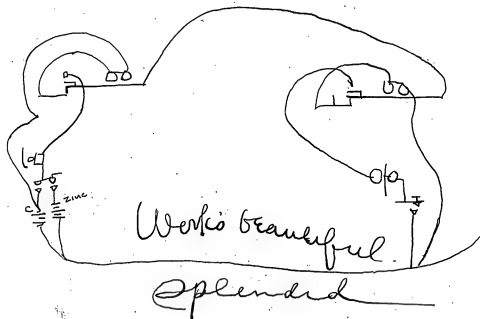
May 10. 1876

Emm



# TRACINGS

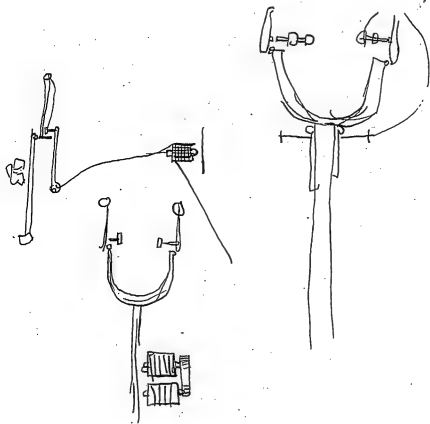




May 10 1896  
~~Chapman Edison~~  
 Even with a single contact  
 only display with slight magnesium or cadmium far off what but

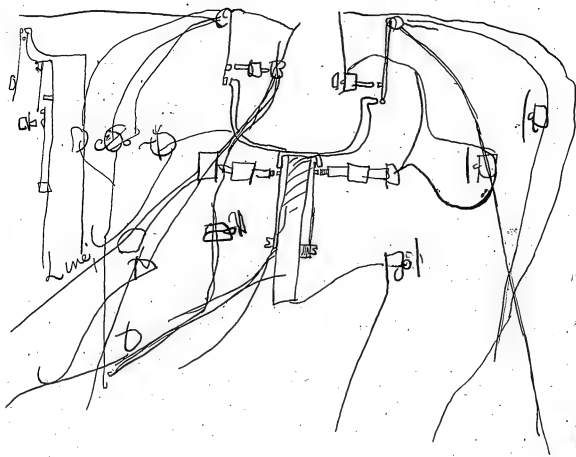
(Better than Com. only)

TRACINGS

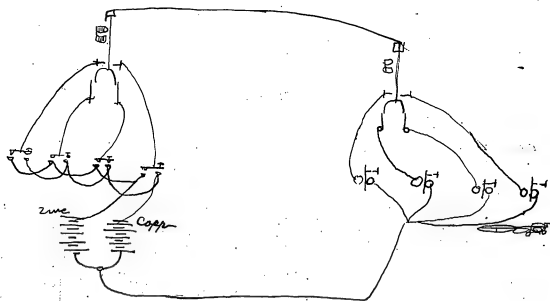




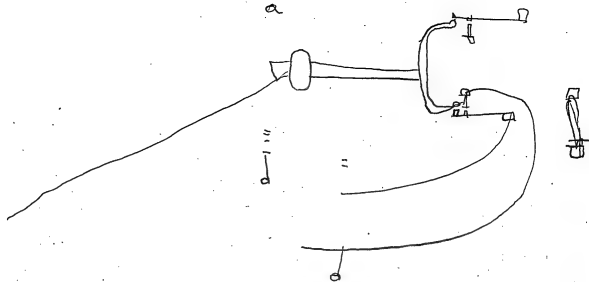
TRACINGS



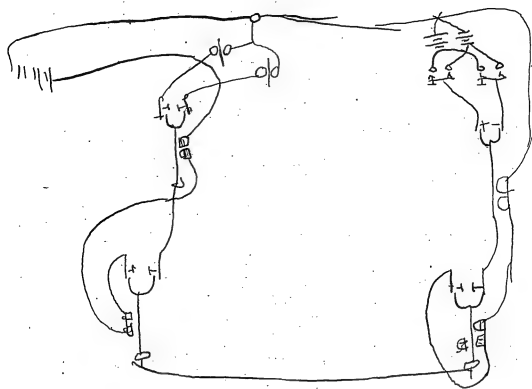
# TRACINGS



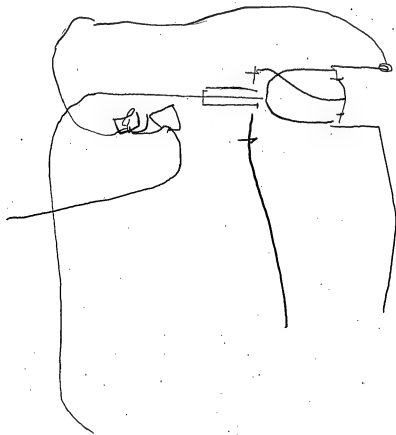
TRACINGS



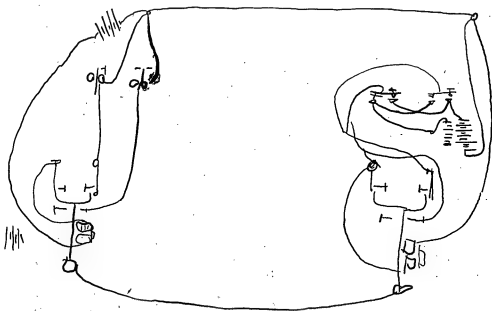
TRACINGS

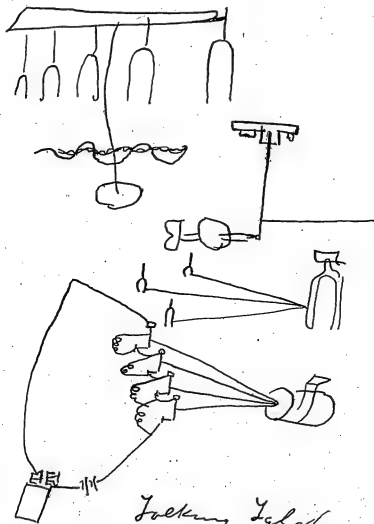


TRACINGS



TRACINGS



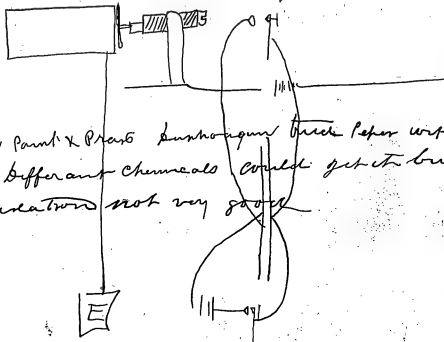


Looking Lalghe  
 July 12 1876  
 Edison

Spectrum

6th 1876

James Adams



Blaine Paint & Paste Sunbonnet Trade Paper not  
 with different chemicals could get it but  
 as circulation not very good



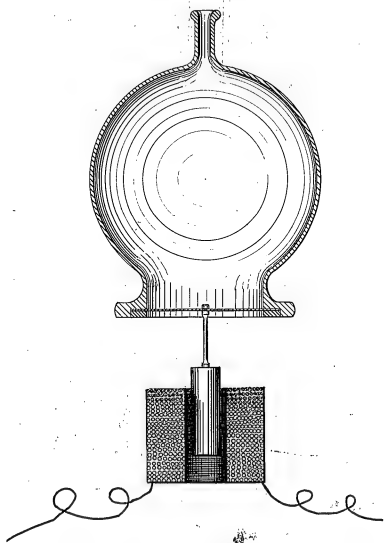
1876. Telephone (NS-76-003)

This drawing was probably made by Samuel Dittrich Mott in 1879 or 1880, but it refers to a device for which Edison claimed to have filed a patent in 1876.

# *Edison's Telephone Record*

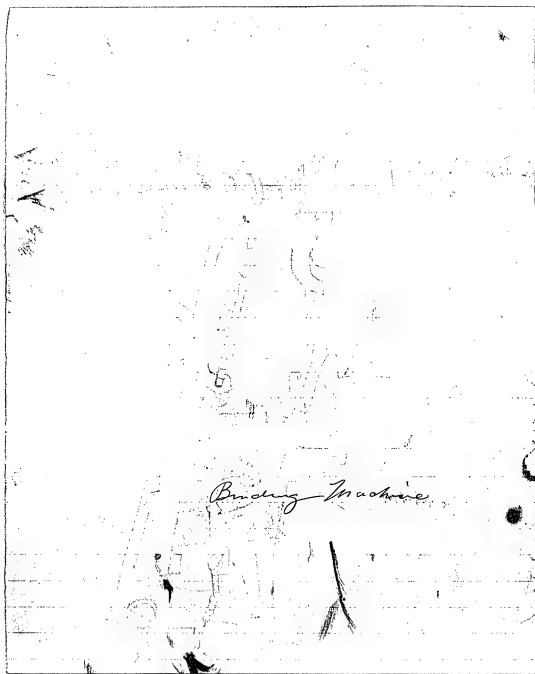
*Filed January 14, 1876.*

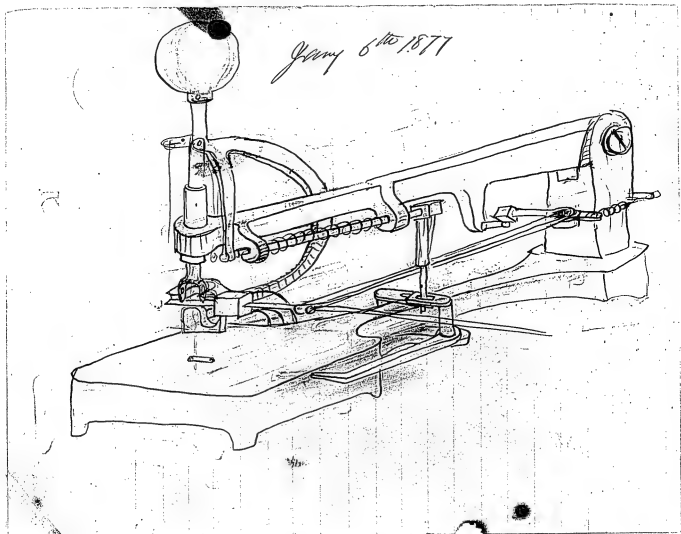
*1 month before Bell or Gray*

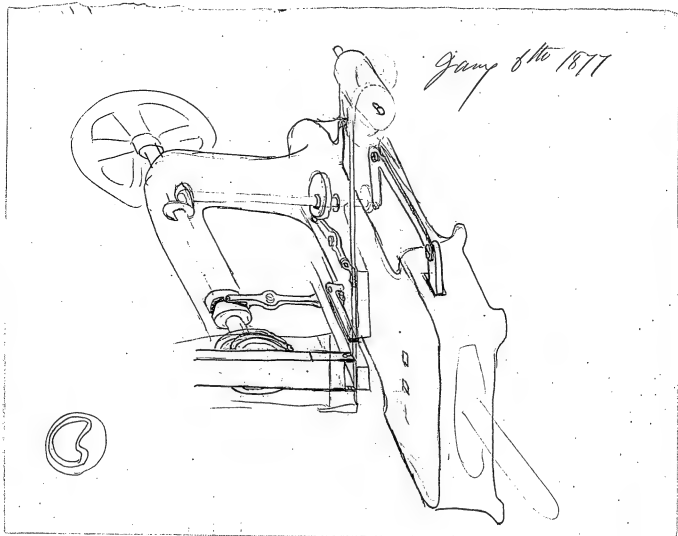


*Edison's Magneto Telephone.*

1877. General (NS-77-001)

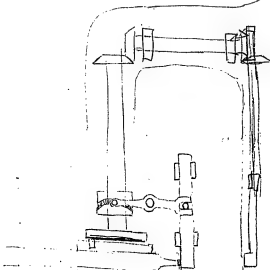


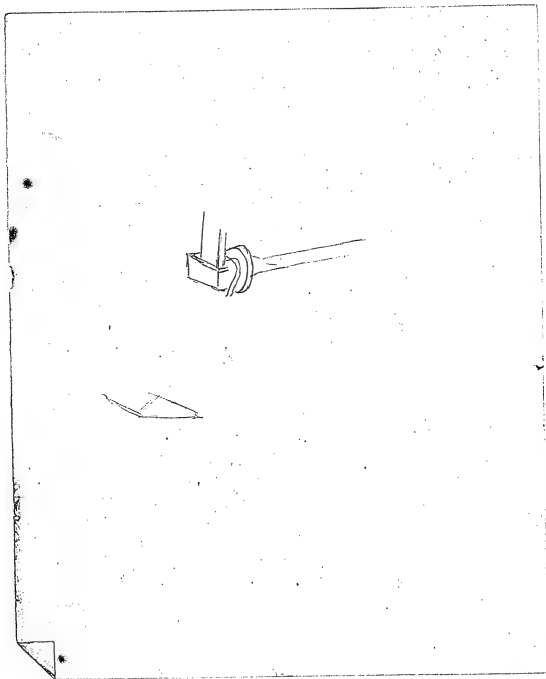




Jan 6<sup>th</sup> 1877

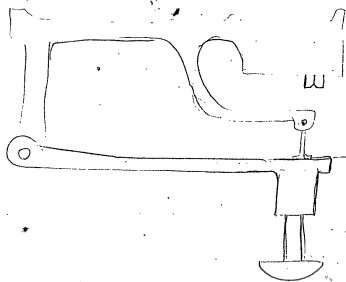
Sam  
Sam

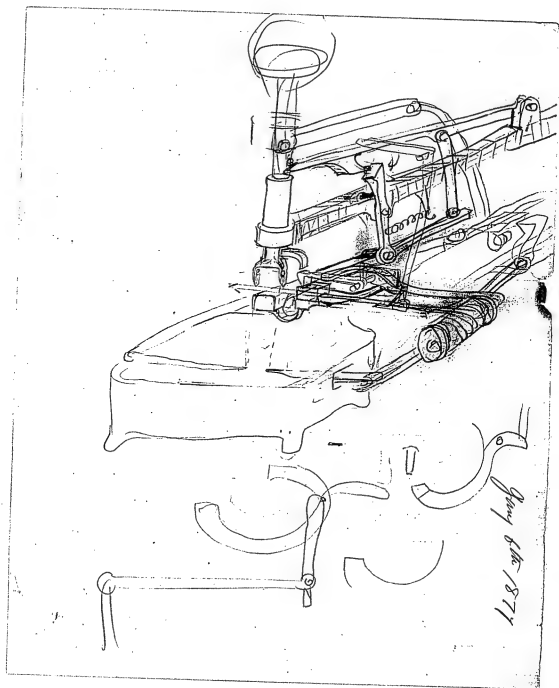




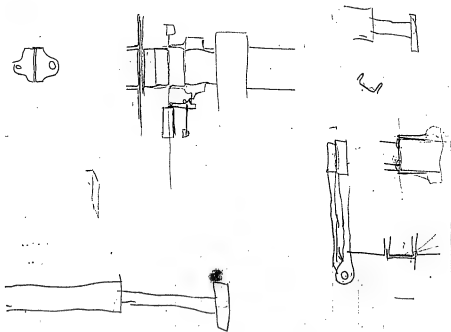


Jan 6th 1877



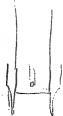


Jan 6<sup>th</sup> 1877

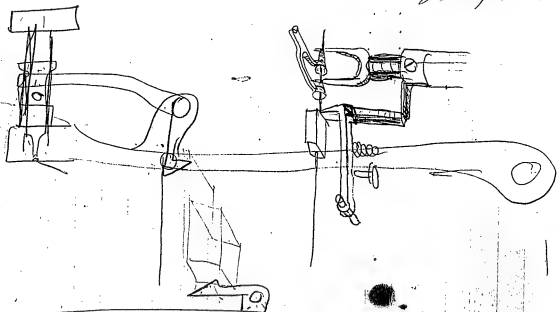


22

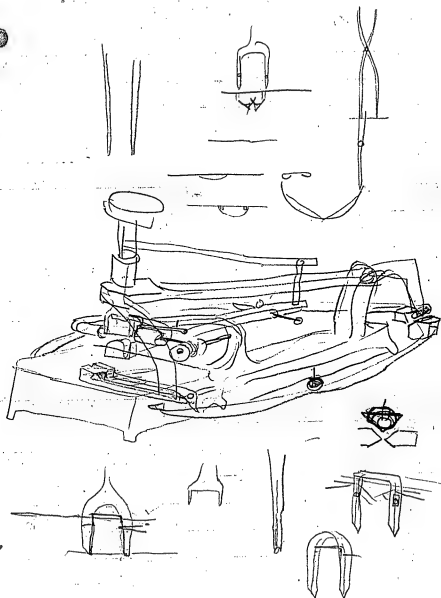
Hold the wire  
feed the wire  
stop the wire  
cut off the wire  
bend the wire  
close the ends  
hold the paper

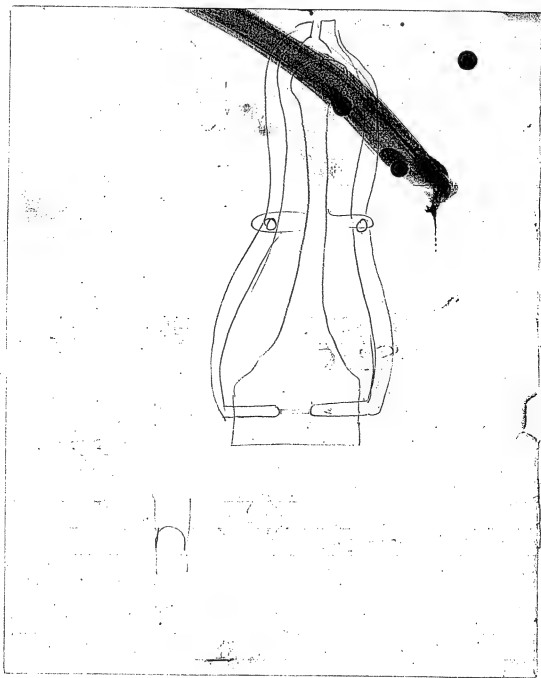


Hand 640 871



Jan 6th 1877



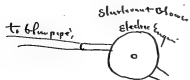


Electric Engines to run ventilators

1877-01-10



Engine  
ball bearings  
run with  
oil  
Bipolarization



July 10 1877



Put polishing tools in Electric Engine Krugi now making =

Engine to Run a Music Box =

Little Lamp Engine fixed to a clock  
to run it =

Electric Engine to Run a Gramophone record =

(Electric Engine)

Electric Engines for spraying +  
Vaporizing Gasoline, for Household  
gas light + for chandeliers lights =



Why not bind books especially those to be written  
in with rubber bands. Thread so book  
will lay flat when opened =

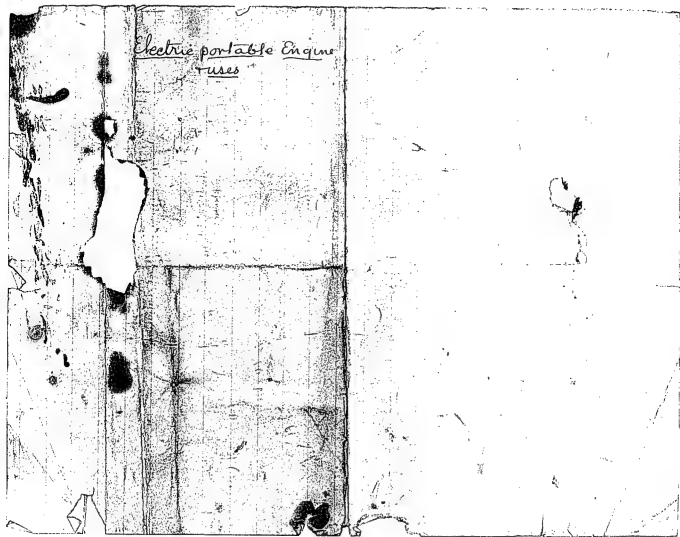
3000



With Electric Engine drive  
Machines in type suitable for conversion  
of power suitable for driving  
of machinery in power

1000





Hunting for Phenomenon

May 7 1877

J. A. Edwards  
~~Chas. B. Bletcher~~  
James Adams

Thurpentine Pyroxylic spirit - paper immersed  
for 2 or 3 months in liquid. becomes  
brittle and can be kneaded in the  
fingers but not like that in  
white Thyme -



you see two ends of the pen  
paper by holding bottle  
containing small quantity  
fluid at angle -

Iodide of  $Hg^{red}$  in alcohol apparently  
insoluble yet I find in 2 or 3  
months that most of  $Hg$  has gone on  
by some action on side of bottle towards  
light above the solution & balance has  
gone up the slip of paper to top of bottle

Notes ~~on~~

May 26 1877

Liebig & Kopp. Repts Vol 1

P. 114. describes train spinning fan revolving in oil.

= big, large sectional area tube, tends ~~under~~ lower note. 115 p.

Jalisco  
Chaparral

Dellani deduces observation of Galloni that tightly stretched iron wire  
- free air sound only on change of weather - no sound obtained  
- either fine, rainy or very windy weather =

Blue ink - Paris blue in oxalic acid. Vide p 155-

227 = 9 is for the stat that polarization increases by  
Cord that the E.M.G. will work better in cold than  
hot weather & better when the power is not  
drawn so fast as to heat the platin. point -

229 = 9. infers when but little sil. Cop. in Calland  
Cell & others in series have plenty that all  
will polarize as decomp. is greater than there is  
Vitrul to decomp. hence appearance of 1st dry drop.

237 = Auto Current breaker Neeff. 1839 (2)  
renamed by Formant Paris 1847 = (3) =

238 = in electric light Carbon point being separated

the arc is reestablished by the discharge of a  
powerful Leyden spark from Carbon to  
Carbon this carries over particles &

Establish the Current -

(Continued)

May 26/77

7 Alderway

rod of conducting substance Hg etc through  
which current passes, & which is interrupted with a  
vibrato when placed on the pole of a powerful  
electro magnet page 239 Chapman's

242 = says best way get oxygen used conc sulph zinc  
with undissolved crystals = Note of think in my Eng  
Expts of noticed & noted in book powerful acid  
from chl zinc & one or 2 others phosphate of soda of  
thence -

Try chloride Lime & Sugar - also chl Lime with  
sol. of lime

P 300. = says that hydrides of metals only finely divided  
metals in says neg pale lat bat with below and many  
Tale = has mistaken - Vol. 1

61. Vol. III - Sainte-Provere, proposed 1849. build telg.  
of solid rods & tubes filled with ~~the~~ a liquid & telg.  
between them

Vol 4 - p 83 = Page says Trussell's voltes may be made  
40 sheets shows how

Continued

33. p. Voll - 2. big 17. K. 17. K.

To salmone <sup>500</sup> 100 ml in 90° Pot. add anise or fennel oil  
drop by drop agitate mixture a gelatinous mass  
produced which on extra alcohol yields product 60% +  
washes with AP. Daz3 Ray whole. highly effective = fuses 100°  
to vitreous on cooling. *Ch. 2/20/1937*

Vol 14 p. 10

clasp your hand in either then in bathing water or  
maltine food. it feels cool.

By putting the eyes close to, good sized, printing at a point where the printing appears very blurred and <sup>single</sup> double images affect better the faster double letter will appear blue, to make

July 21 1877

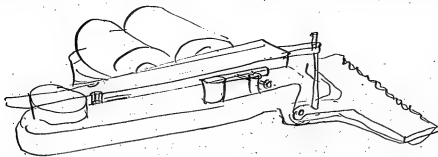
Sheet rubber quickly stretched  
becomes heated suddenly allowed  
to assume its normal position  
it becomes colder than its  
normal temperature

If a strip of vulcanized rubber  $\frac{1}{2}$  inch  
long  $2\frac{1}{2}$  wide be placed grasped by the  
ends at each end the center being  
placed over the lips the slightest  
bending causes it to assume its

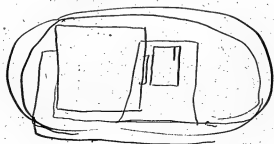
normal position and to become cold  
it is found as a rule that the  
upper part of the strip is  
the warmest part of the  
strip and the lower part  
the coldest part of the  
strip

Horse Churn  
worked by Aerovib  
Reid =

Aug 6 1877  
J. Alden

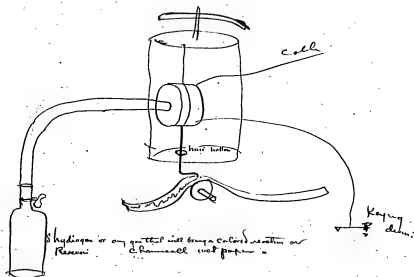


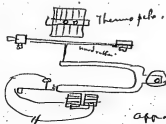
1070



Edmund Renshaw Galvanic

Aug 7 1877





apparatus for transforming heat waves into electric waves

September 9 1877

3rd Edition

Chas B. Barchelor

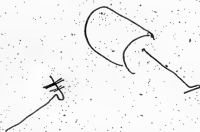
James Adams

J. H. H. H.

W. C. H. H.

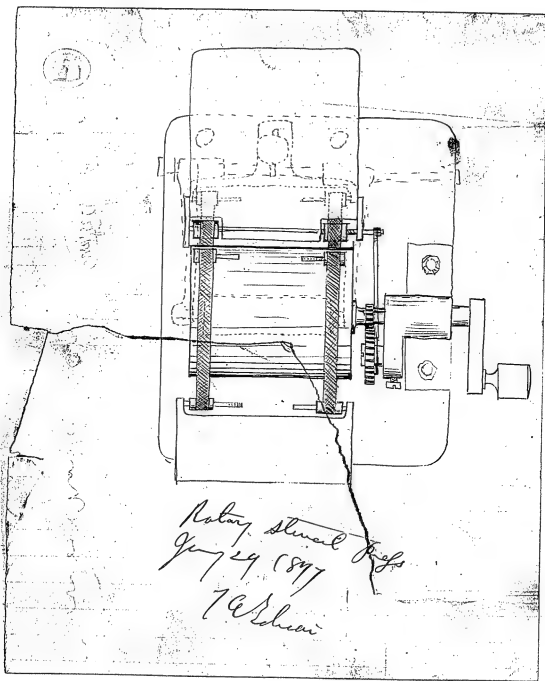
M. H. H. H.

I notice with the said vulcanite that after you have worked it for  $\frac{1}{2}$  minute or so it is far more sensitive <sup>in producing</sup> the heat & cold waves & if placed against the mouth after working strongly for  $\frac{1}{2}$  minute then the slightest movement will cause these waves to be felt =

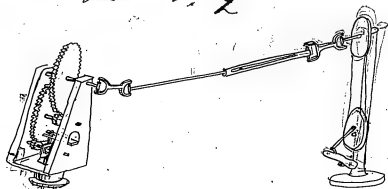




1877. Electric Pen and Duplicating Press (NS-77-002)



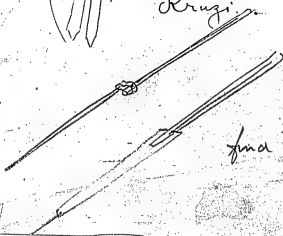
~~No. 1~~ No. 2



Model,

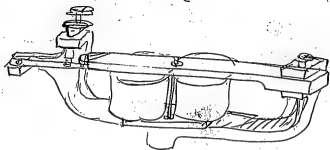
Krugis

8/17



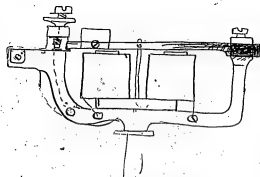
final date March 28th  
1877

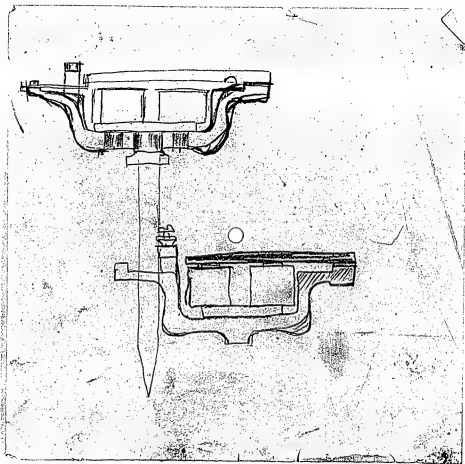
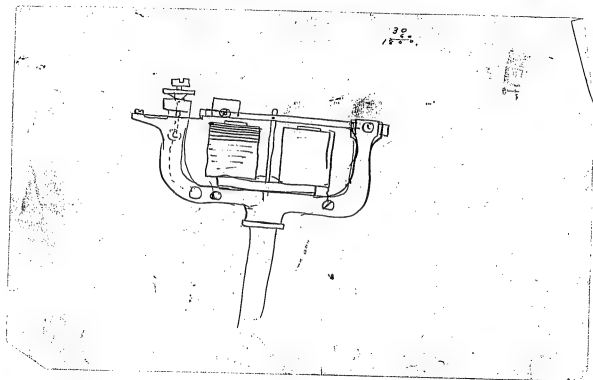
Fig 6. 87.



88

Fig 1 Delivered April 10th 1877  
Fig 2 " " 11th





Sept 30<sup>th</sup> 1877

## Copying Experiments

A number of copies at once

1. Wrote with liquid arsenic acid and let dry, then we soaked piece of blotting paper with aniline violet and Glycerine and took impressions in copying press by pressure only slight at first.

Result The ink also soaks through the paper and even with bond paper the press presses it through in some places

2. When we wrote with ordinary Ink with a little Acetic Acid in it and dampened the sheets with water that had a little Arsenic acid in it we could get 5 copies at once on tissue paper

3

~~to find an oil or other liquid that will not go through~~  
to find an oil or other liquid that will not go through

Panama

oil Cade goes through quick

oil Argemone goes through, but dry very fast

oil Cajuput "

Balsam Copaiba "

Balsam Peru "

Neats Foot oil "

Union Salad oil "

Sperm oil "

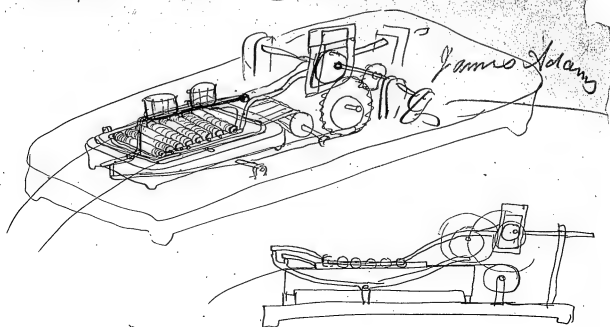
Slightly

John Adams

## Autographic Printing

June 10 1877

J. A. Brown



## Autographic Stencil Press — Continuous Roll printing

I have tried the stencil on a Gordon press with a cloth but this don't give good printing = I propose to put a train of rollers which are to take the place of the regular roll or the Gordon Press roll method of pressing =

# Autographic Printing

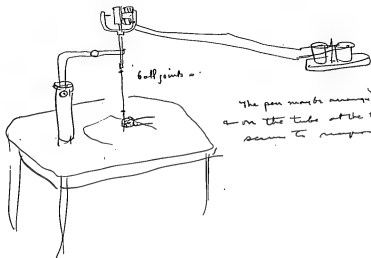
June 10 18  
T A Egan

I wrote on a high headed paper with ~~James~~  
or Acetate of Manganese, the di-  
signs & allows ink to pass through & give  
many impressions -

I claim writing on proper paper with arsenic  
acid & acetate of manganese & filling the  
stencilled up writing with gum for the use of  
the blind -



By this arrangement you move  
the paper instead of the  
pen



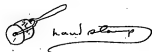
The pen moves around to rotate the sheet  
on the table at the top is the cam which  
serves to represent the needle.



Autographic Printing =

June 10 1877

I propose to coat hard rubber with a  
conducting substance for static Electricity  
& write on it with a point thus bearing  
like hard rubber & then propose to  
Electrify it & behold it over powdered  
dry ash or lamp black & take  
impression from it. or coat rubber  
with a conducting substance with an  
aperture of paper with a substance which  
when pressed on the rubber will take off the  
conducting substance & leave rubber  
bare ready for Electrifying.



I just tried regular thick printer ink with a stencil  
& find that with rolling it's too sticky  
but will work by pressure =

James Adams

Autographic printing -

June 10 1877

Boston

Edison

Wash

Make a vibrant, par vibracant a  
magnet to make the way

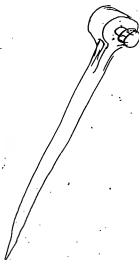
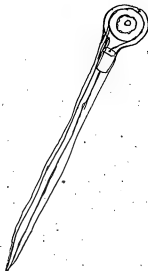
Boston

**Boston**

James Adams

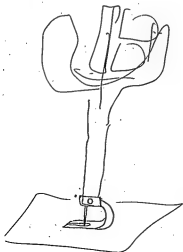
Boston

Boston



# Electric Pen

June 10 1877



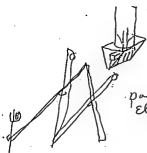
Works with:

I have a new process for duplicating and it works well. I take hand-erased paper coat it with wax on the ends cold then write with a pencil the scratch the wax away where you write, & then wet a pad with aniline ink & lay it on the wax side (in writing the sheet then warped on the other side the ink comes through where the wax is gone & looks any no. of deep can be taken



music drawn several needles

James Adams



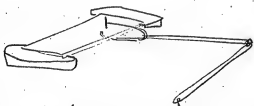
Paralograph with Electric pen

I propose to write with an amalgam of mercury & sodium lay this on a smooth iron plate, and it will amalgamate the iron <sup>where written</sup> & then connect iron to zinc of a battery & smooth my paper in ferrodag and polonium fact lay the iron over the other metal plate connected to the Carbon pole of a battery. the mercury will prevent the iron re-oxidizing + it will look like a blue black ground

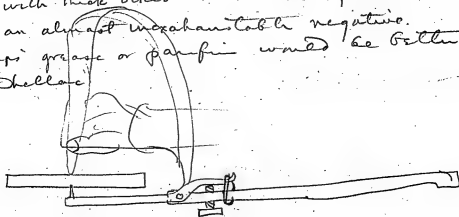
Autographic printing

June 12 1877

J. A. R. L.



Sheet covered with plaster paper & scratch  
underneath then shellac'd or other material then  
filled with thick varnish and line dried & polished it  
forms an almost inexhaustible negative.  
perhaps grease or paraffin would be better than  
the shellac



June 20 1877

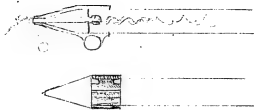
No 36  
45

Fixing Chisel for Sun foil glass  
in Electric pen

\$2<sup>00</sup><sub>100</sub>

Edison

2.10  
~~\$2.50~~



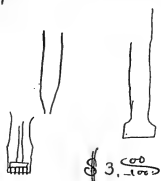
June 20 1877

Electric Pen for  
Music

J. A. [unclear]

////

No 37  
H. 10

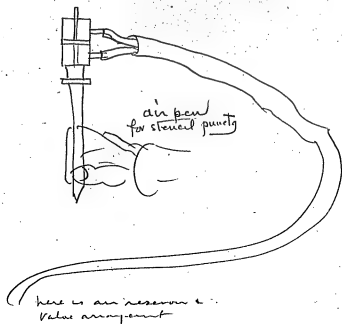


\$ 3.<sup>00</sup>/<sub>100</sub>

6

# Puncturing pen

June 21 1877  
J A Edison



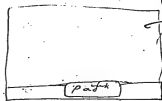
new process I coat this  
high sized paper with a  
flexible varnish which  
never dries, or with paraffin  
or other substance, I coat it  
on one side only taking care

that none goes in the paper itself I lay this on a hard  
surface and write with a stylus or sharp point this  
scratches off the paraffin or varnish and I sponge the  
varnished surface with Hydrochloric or Arsenic  
acid this eats the size of the paper at the point  
left bare and then I lay the varnished side  
down on an ink pad & the thing acts as a proxy stencil for  
taking any number of copies

Multiple Copying Process

June 26 1877

W. A. Swan





Message from New York  
To J. A. Edison May 7<sup>th</sup> 1878  
do you wish us to come to Morron  
morning sig

~~Q. O. Walker~~

Q. O. Walker

com do morron morning

B. Patchen

Ja

Autographic Printing, June 27<sup>th</sup> 1871

James Adams



write on paper with Collodion Electrify the MSS by rubbing with dry substance - dust and line dust over a flat surface with a sieve - put Collodion Sheet MSS in frame & lower it while Electrified with  $\frac{1}{32}$  inch of the Ambric twice attract the particles & these adhere to the Collodion MSS, can be transferred to a wet sheet the Collodion MSS is dry viz while you print from the transfer sheet when dry re-electrify & go over same process.

Taking Multiple Impressions  
Analogous Printing

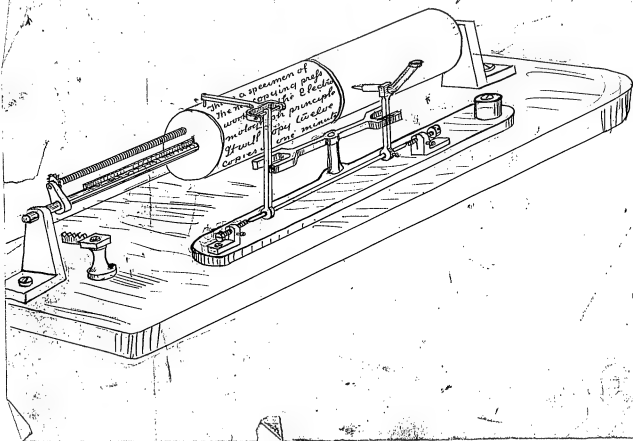
June 29 1847  
T. Adams

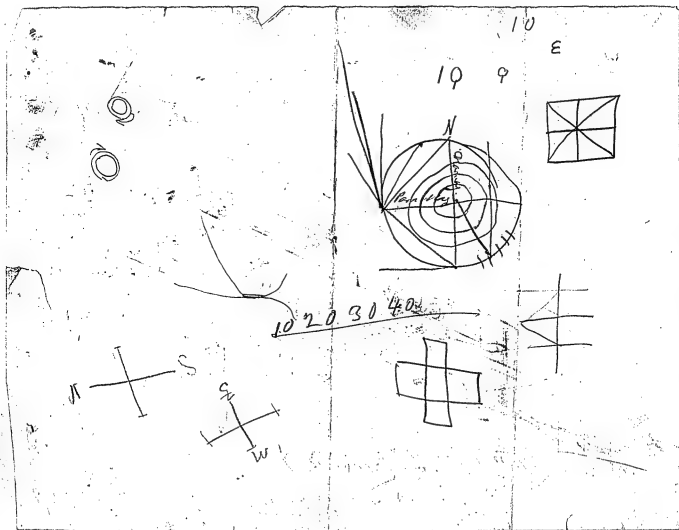
James Adams

Just discovered & tried first class process for  
Duplicating Letters etc = I take a piece  
of paper, not slightly gelatin, pass it through a  
bath of Collodion scraping off excess let it  
dry then lay it on blotting pad & write  
with a stylus. of silver the slightly embossed  
it & the object is to break the Collodion  
where it is written on & this sheet laid on  
an into paid the ink will come through where  
the Collodion is broken & ~~the~~ the mes may  
be duplicated to any extent = I find  
that the gums in alcohol or other menstrum  
will do the same thing, in fact almost  
any substance that causes the paper to be  
superior to & prevent the passage of the  
ink & ~~substance~~ can be used = Even printers  
ink thinned by an oil can be used  
although an aniline or colored ink  
works better =

T. A. Edison

Chas. Ketchum  
New York Jan 1878



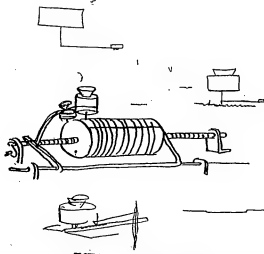


1377. Phonograph (NS-77-003)

Included in this folder is a drawing containing the inscription "Kreusi Make This Edison August 12/77." Although this was once considered to be the drawing from which John Krüsi constructed the first phonograph, the evidence suggests that the inscription was added at a later date. It does not appear on the reproduction of the drawing in William K.L. Dickson's biography of Edison, published in 1894, nor on the reproduction in James U. MacKenzie's obituary in the Electrical World in 1895.

This folder also contains facsimiles that were prepared for use as exhibits in the case of American Graphophone Company v. Edison Phonograph Works. These have been filmed after the other notes and drawings.

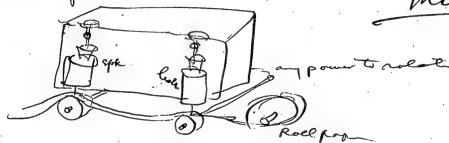
8387



Kreuz  
Markthaus  
Aug 12/87  
Edmon

Phonograph

Aug 12 1877  
W. H. P.



Input in Bell Telephone can put return on end of  
 gold. Stay clear across diaphragm,  
 also



any sketch permanent magnet - use wax flange  
 in cup between diaphragm & plate allowing speaking  
 tube be perpendicular -



Phonograph

Sept 19 1877

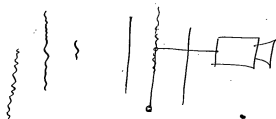
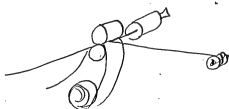
Ta Edison

Chas. Batchelor

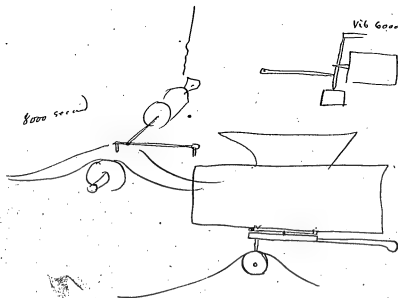
Johnsen

Ed. Carman

M. M. Force



vib 8000 Sec.



Vib 6000 Sec.

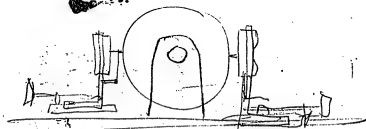
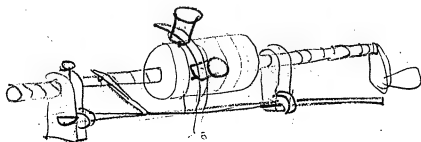


Patented  
1877  
Edison

582

Phonograph.

Nov 29<sup>th</sup> 1877  
T A Edison  
Chas Batchelor  
J. K. Mearns

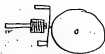


Telegraphic Telegraph Dec 3 1877.  
7th Edition

We find that a very good device for  
transmitting is to emboss the foil paper  
& cause induction to rise & lower  
a. Contact lever =

James Adams

Phonograph -



Recording by magnet works at but not so  
strong as with voice, requires our loudest  
Telephone to do the job -

FACSIMILES

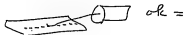
Ames, Joseph Co.  
Edison Phon Works.  
Refundants Ed. & J. Phonograph  
Sketch Sept. 9/17.  
E. & J.

Phonograph



The indgo. Xc might be off parallel in other substance which  
would make way.

We tried not in make the



September 9 1877

Edison

Charles Adams  
Johnnesi  
Ed. & J.

Ed. & J.

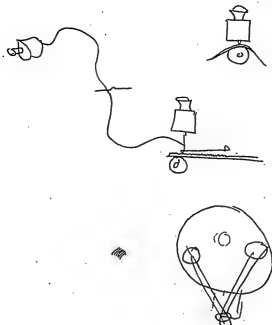
Ed. & J.

FACSIMILES

*Amman & Phelps Co.  
Electric Telegraph Works  
Riverside, Cal. 11/29/77.  
Sched. of 12/11/77.  
S.B. Co.*

*Expt 8 or 9. 1177*

*Shaw-Batchelor  
A. Edison  
J. H. Kinsley  
H. C. Kinsley  
W. M. Ford*





Phonograph <sup>Amusement</sup> <sup>Office</sup> <sup>of</sup> <sup>the</sup> <sup>U.S.</sup> <sup>Dept.</sup> <sup>of</sup> <sup>the</sup> <sup>Interior</sup> <sup>at</sup> <sup>Washington</sup> <sup>D.C.</sup> <sup>Dec 29 1877</sup>  
 Dec 29 1877  
 J. A. Schmitt  
 J. A. Schmitt  
 J. A. Schmitt  
 J. A. Schmitt

I propose to apply the principle of the  
 Phonograph to various purposes  
 such as cast wheel or wheel only  
 Electrotype Enbored indented  
 + other metallic bands containing  
 a speech or picture to be applied  
 to Dolls & various toys to be  
 turned by hand or by other means  
 also I propose to apply these  
 wheel to Clocks, watches to tell  
 the hour etc, for advertisement  
 for carrying out directions automatically  
 Behaving, Lecturing, Explaining, The way  
~~to~~ as a musical instrument  
 where sheets of wheel or enbored  
 music may be read & played by  
 pressing them by slapping on a  
 disc or wheel etc.  
 J. A. Schmitt sheet & wheel of music

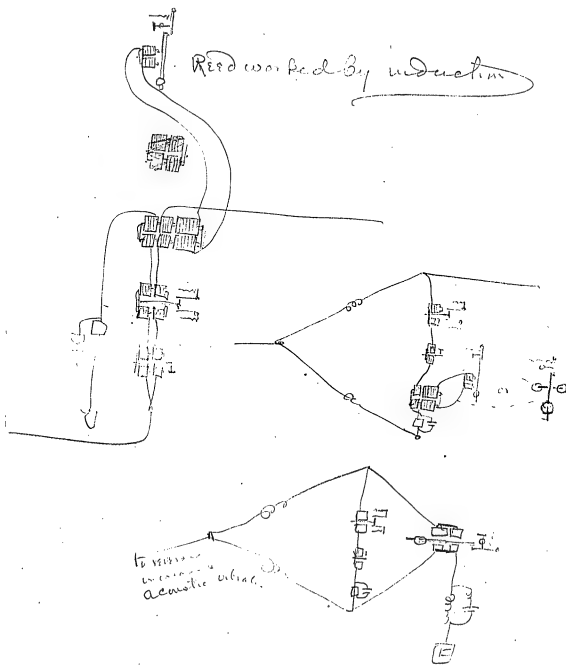
1877. Telegraph (NS-77-004)

Filmed in the following order: a series of notes and drawings labeled "Sextuplex," which were probably once clipped together; other notes and drawings; tracings.



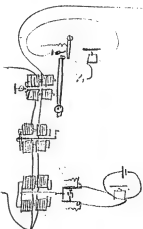
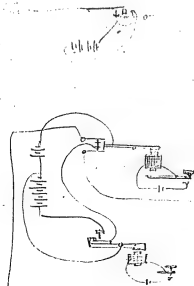
Sextuplex

April 14 1897  
T. A. Edison

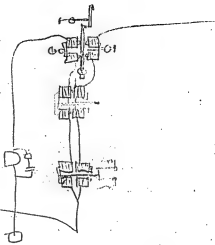
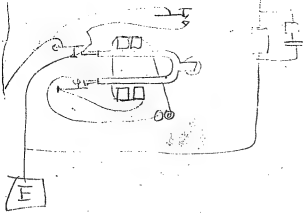


Sextuplex

April 4 1877  
J.A. Edison

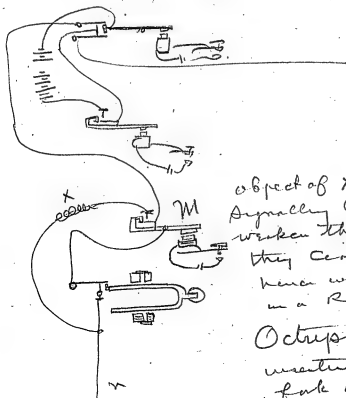


Differential  
Sextuplex



# Octuplex

April 4 1874  
J A Edison



object of X is to cause even  
signally because the vibrations  
when the current and when  
they cease it strengthens it  
here when I stop I throw  
in a Resistor =

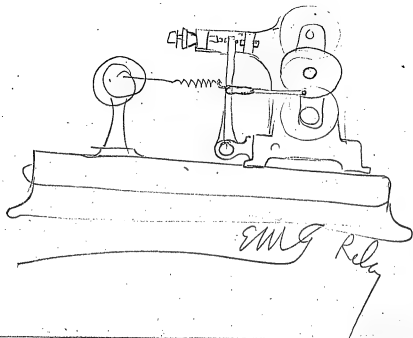
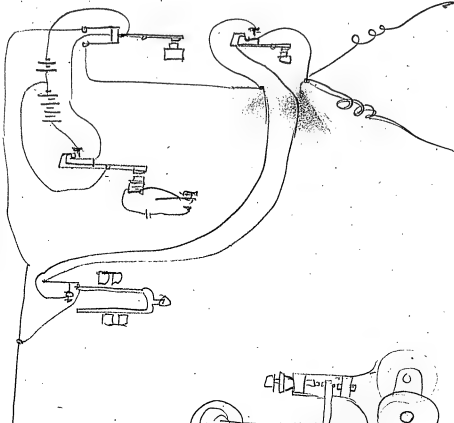
Octuplex is made by  
inserting another tuning  
fork at N before it is  
connected to the Earth  
& this is connected  
exactly like the one

shown but has a different vibrating rate  
and with forks may be inserted as long as  
they can be arranged so as not to  
interfere with the regular pulses  
& maintain current more uniform  
if interrupting the continuity is bad  
& it is not found requisite to use  
M. it may be arranged this

Sextuplex

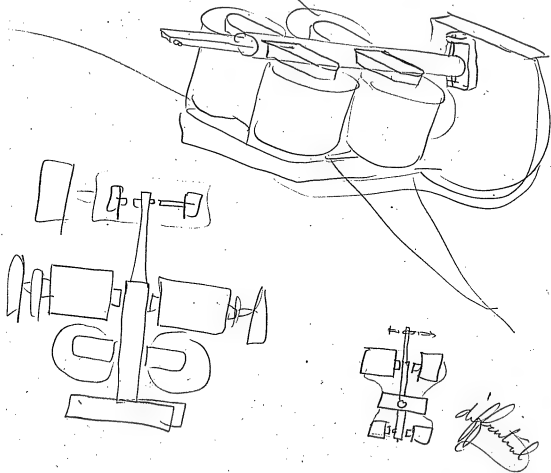
April 4 1894

J. A. E. M.

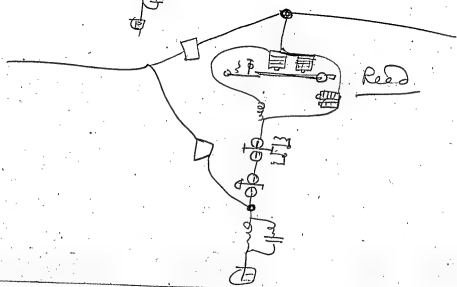
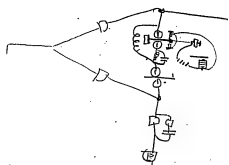
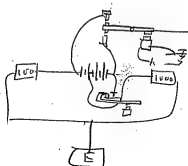
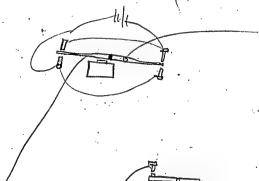


EMG Relay

April 4 1899  
J A Brown

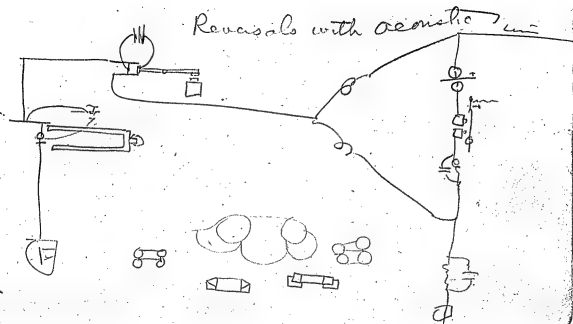
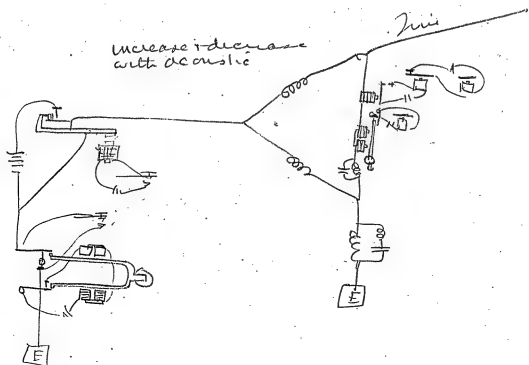


Qing April 4 1877  
 + Six light 7 Arden  
 + 4 dimes



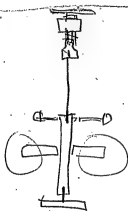
Quadruplex

April 4 1879  
Jadism

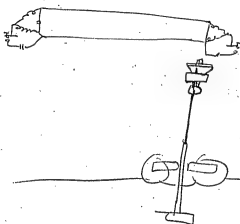
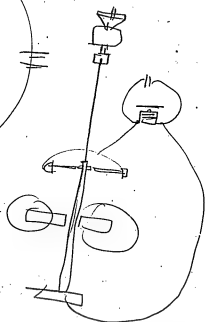
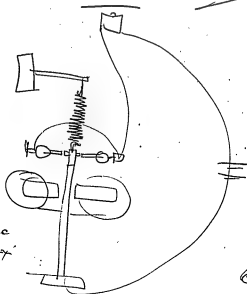


April 18/17

W. H. L. H. H.



Relay  
increase & dec  
in Auduplex



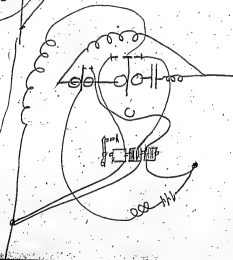
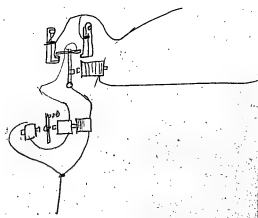
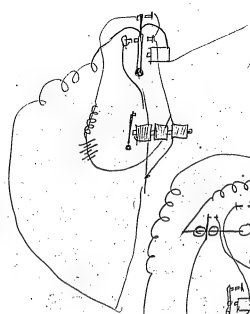
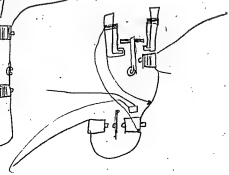
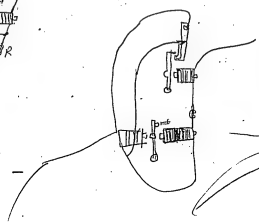
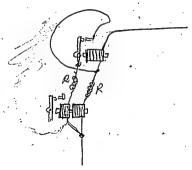
Small  
intensity  
Plumbago  
Coal or Mangn  
blk ox point



Distriplex

April 10 1897

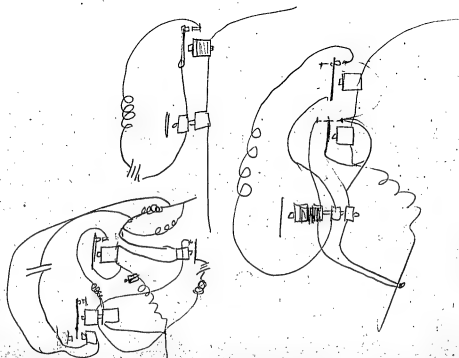
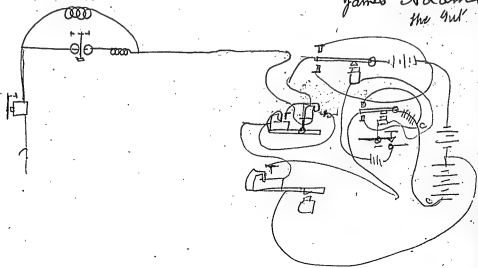
J A Edison  
New Rochelle  
James Adams



Dixtuplex

April 10 1887 -  
Tadbury.

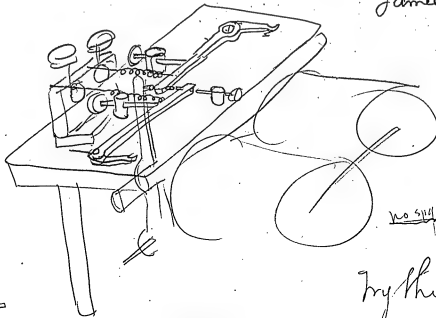
James Adams  
the Gul.



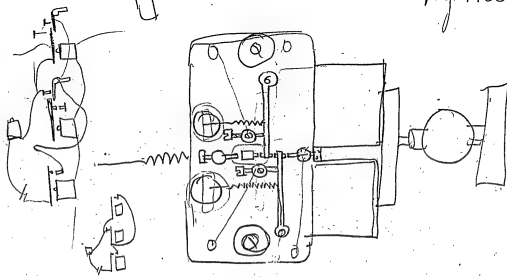
*Graphophone*

April 10 1877  
J A Edison

*Chas. B. Adams*  
James Adams

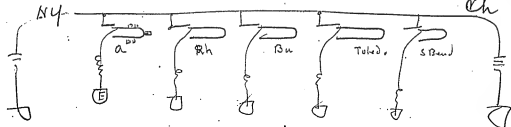


*Try this*

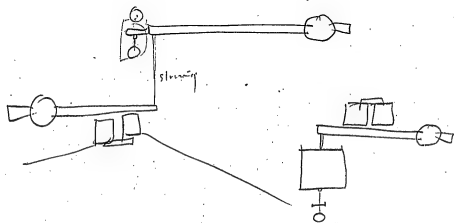


April 10 1877  
 7 Wednes

game of dam  
 ch



discharge line by  
 turning forks worked by  
 a foot



Extrplex

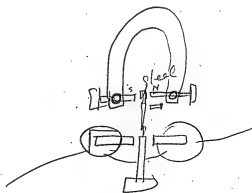
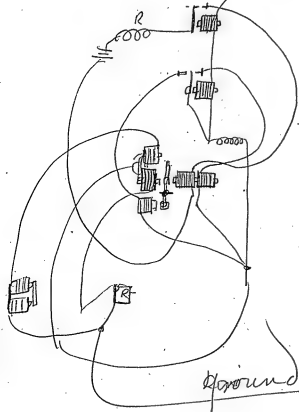
April 10 1877

Fatam

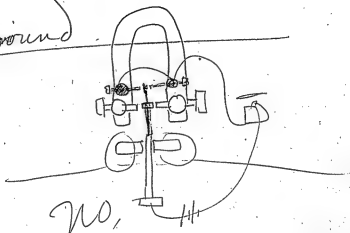
Chas. P. Allen

James Adams

Line

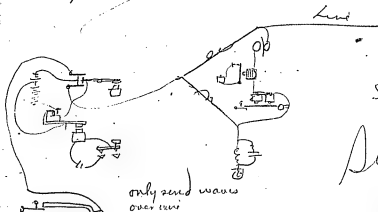
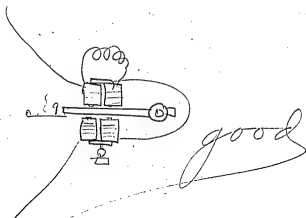


This makes it  
less sensitive to  
weak current.



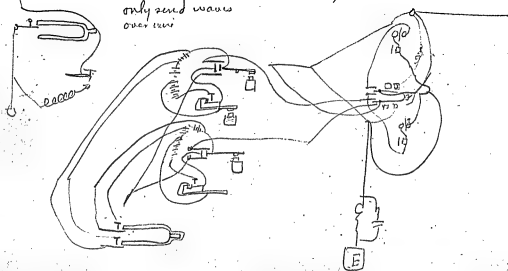
April 10 1897  
J. E. Irving

James Adams  
the artist



Same better end

Sextuplex

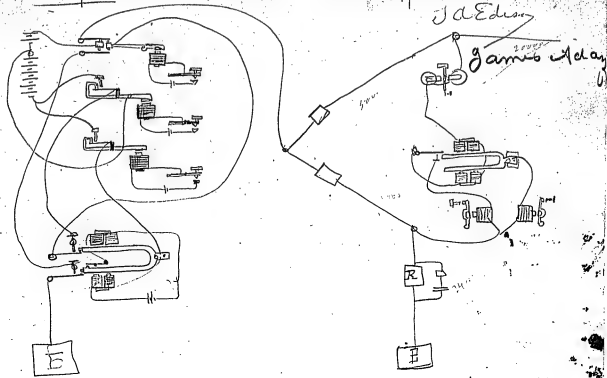


*Dextuplex*

April 10 1877

J A Edison

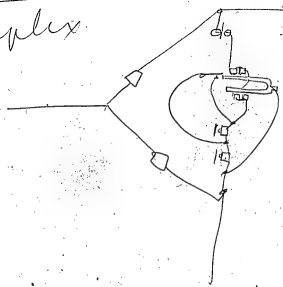
*game delay*



*Dextuplex*

April 11 1877

*T. A. Edison*

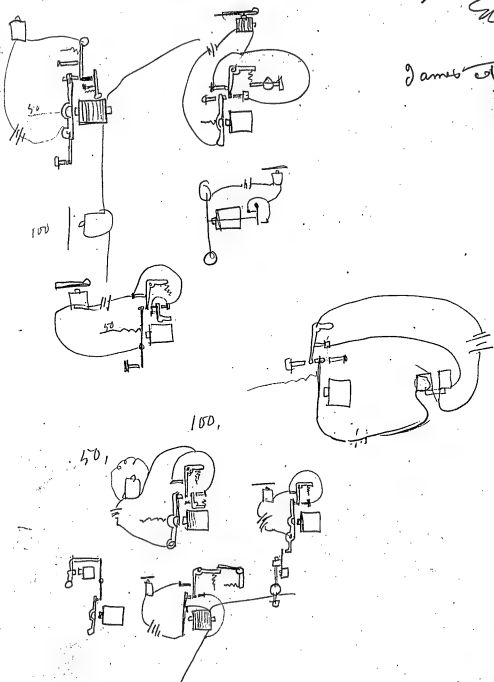


Dextuplex

April 10 1877.

7a Edm

James Adams



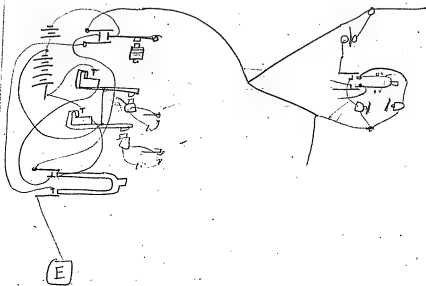


Distuplex

April 10 1877

J. A. Adams

James Adams



Deming

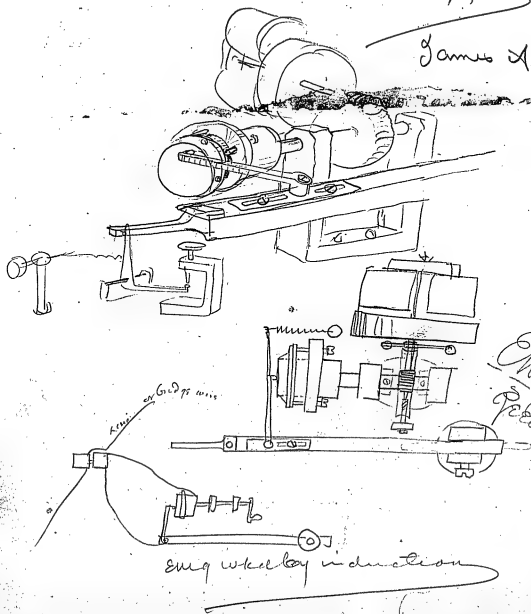
J. A. Edison

April 11 1877

J. A. Edison

J. A. Edison

James Adams

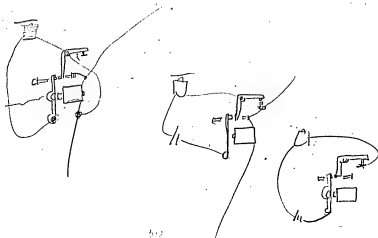


Enclosed

April 11 1877

W. Adams

James Adams



112

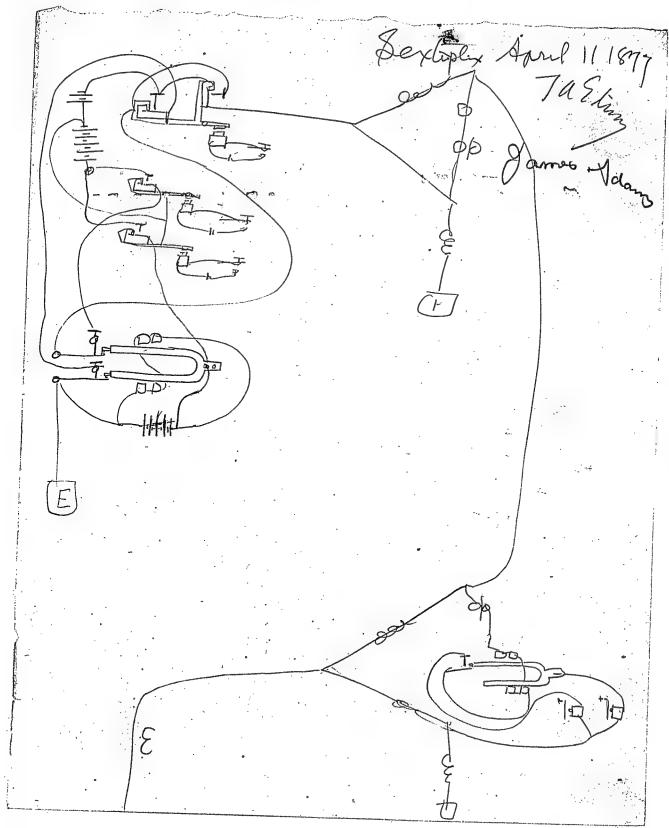
110

Y propose to send with 100 cells Positive reward  
by emboss on 1 line, send with 100 cells Neg reward  
in other line. when both bells in they  
kill each other & no current rewards in a sex and  
line =

Sexton April 11 1877

T. A. Edison

James Adams

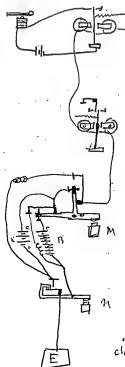


G Smith and

April 17 1897

725

*Chas Walcott*  
James A. Lang



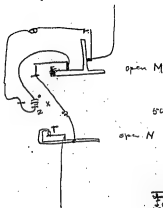
Both open 50 cells 2 to line  
Both closed 50 cells c to line.

~~M closed~~ M closed 100 cells to line  
N closed nothing

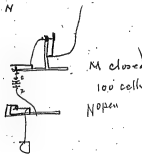
M closed B on  
M open B off  
N closed X off m open  
N open X on  
M closed N open X closed

open X on  
closed X off

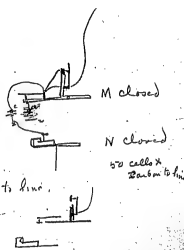
open X on  
closed B on  
no closed X on



50 cells X 2 zinc to line.



M closed  
100 cells carbon to line.



M closed  
N closed  
50 cells X 2 zinc to line

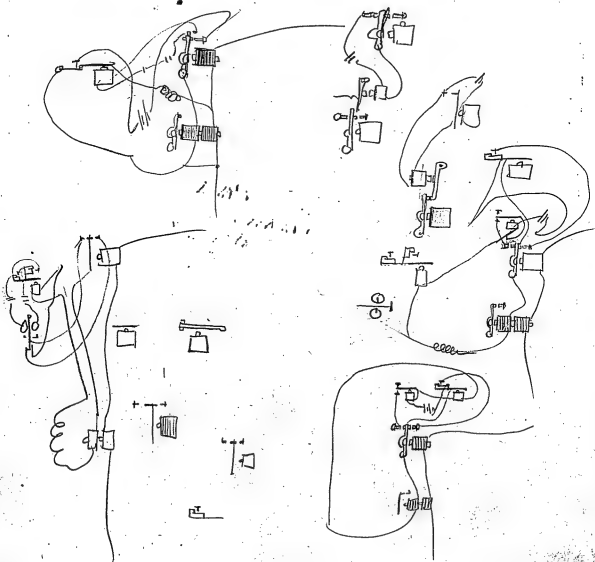
Experiments

April 12 1894

J.A. Dixon

I think rawhide on a small platinum diaphragm would  
be best thing for Em-graph with asymmetric

James Adams



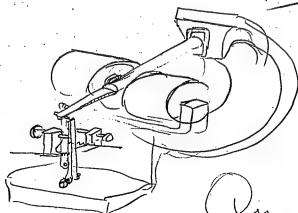
Detmold

April 12 1877

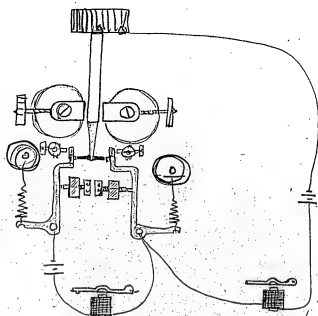
Adams

James Adams

Charzatcheln



Quad



Increase & decrease  
sounder

Reverse current  
sounder

$\frac{18}{54}$

$\frac{105}{18}$   
 $\frac{20}{50}$   
 $\frac{246}{246}$

Delioat  
Delioat

Delioat  
Delioat

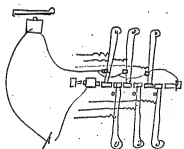
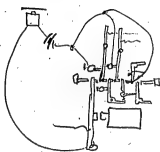
Delioat  
Delioat

April 12 1877

J. Alden

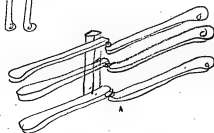
Chas. B. Alden  
Jame Adams

Increase &  
dec Quad &  
350 Sextuply

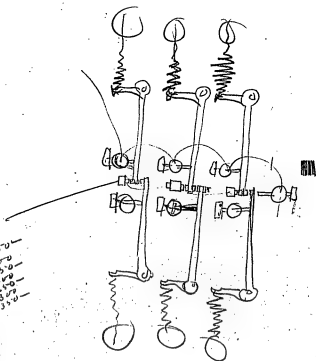


50 100 200

II



100  
200



100  
200  
300  
400  
500  
600  
700  
800  
900  
1000





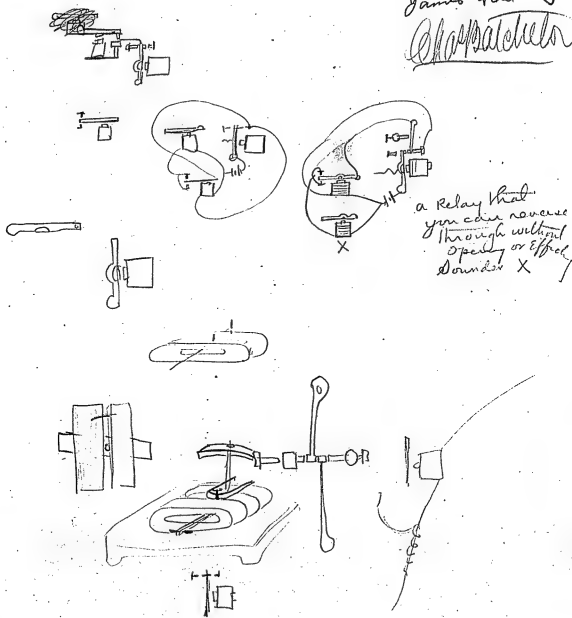
Dr. H. P. L.

April 12. 1877.

J. H. L.

James L.

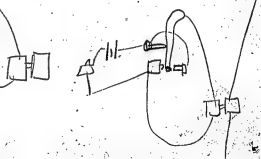
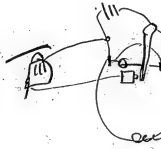
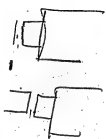
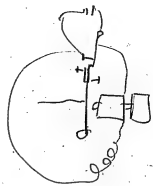
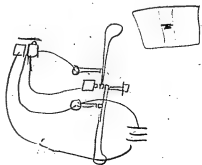
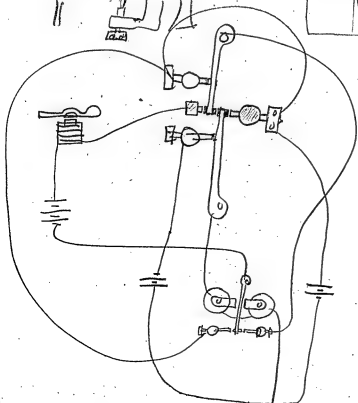
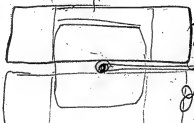
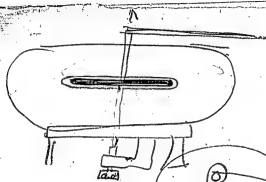
Shattuck



April 13 1877

James Adams

James Adams

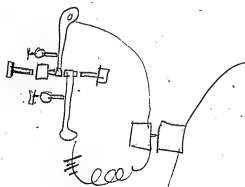


1. 4

16

April 13 1877

J. A. Edwards

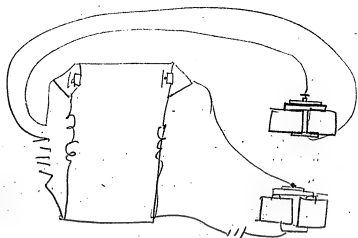


James Adams  
Chas. B. Nichols

Experiments

April 16 1877

J. A. Edwards

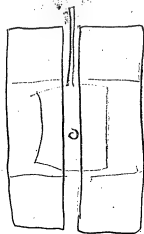
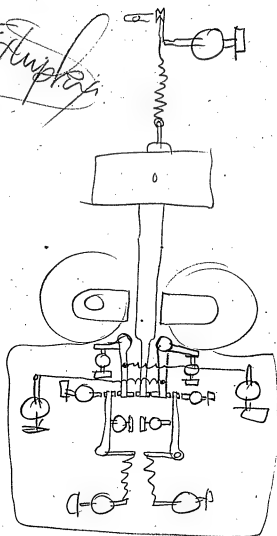


Boston  
Boston  
Boston  
Boston

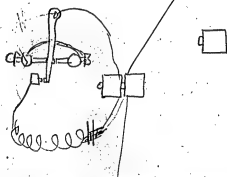
J. H. P. H. P.

April 13 1879

St. Louis  
Chas. Batchelor  
James Adams



increase & decrease  
50 = 100  
Reversals



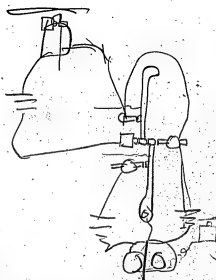
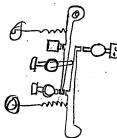
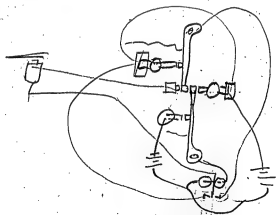
Duplex

April 13 1877

J A Edison

Charcoal

James Adams



50

50

100

125

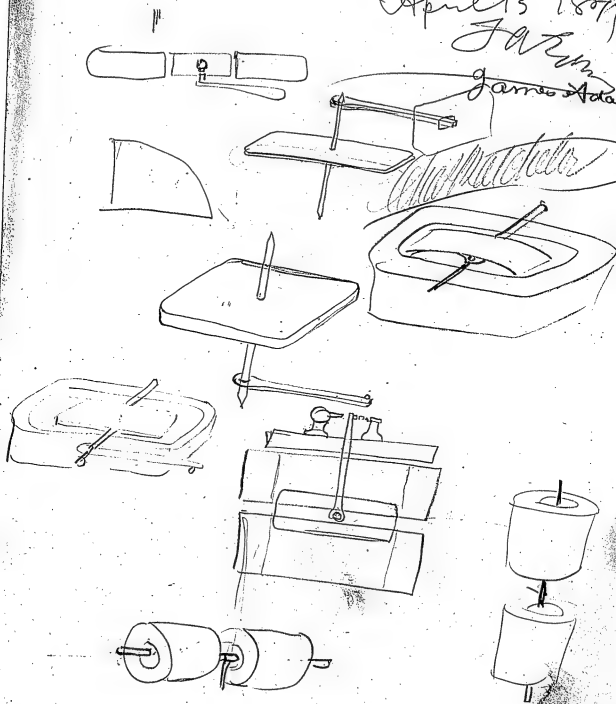
50

April 13 1877

J. A. Adams

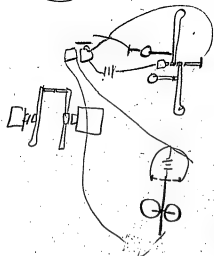
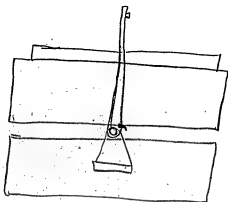
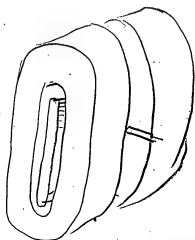
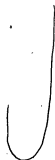
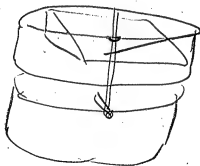
James Adams

John Macdonald



April 13 1899

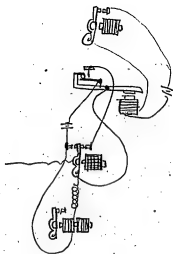
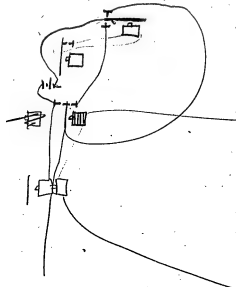
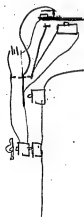
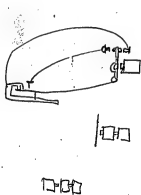
Stedman  
Christopher  
James Adams



Sketches

April 13 1877.  
J A Edison

James Adams  
Chapatchetor



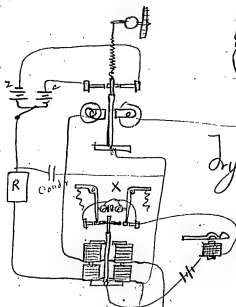
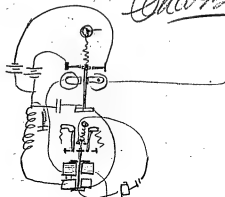


St. Louis

April 14 1897

St. Louis

James Adams  
Chapman



Try this

probably X spgs unnecessary



Duplex

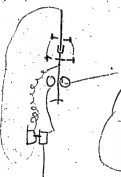
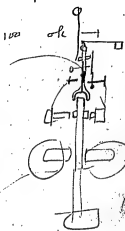
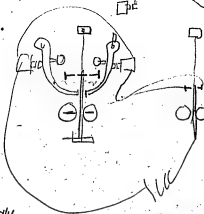
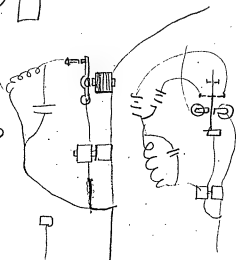
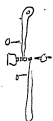
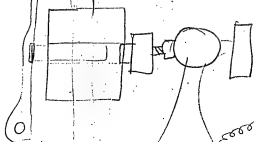
April 14 1877.

J. N. Alden

James Alden  
Chas. Alden



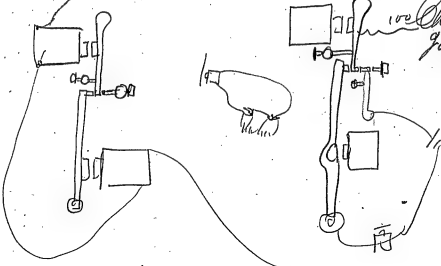
Duplex Relay



Sextuplex

April 14 1897

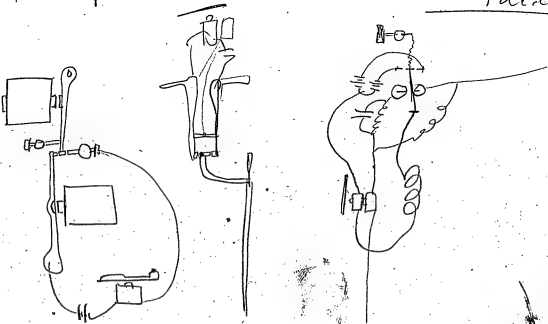
W. J. Davis  
1000  
Chapman  
James Adams



Sextuplex

April 15 1897

W. J. Davis

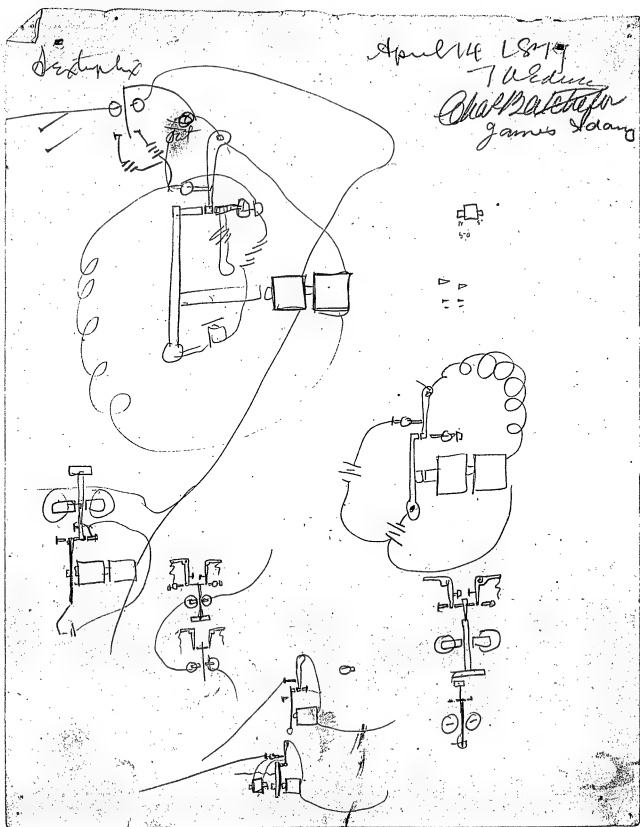


Sketches

April 14 1897

T. Alden

Chapman for  
James Adams



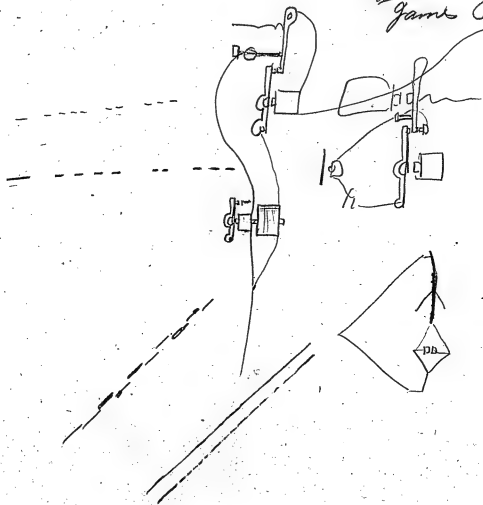
*Dexter*

April 15 - 1877

7a Edition

~~Mr. Mattheu~~

James Adams



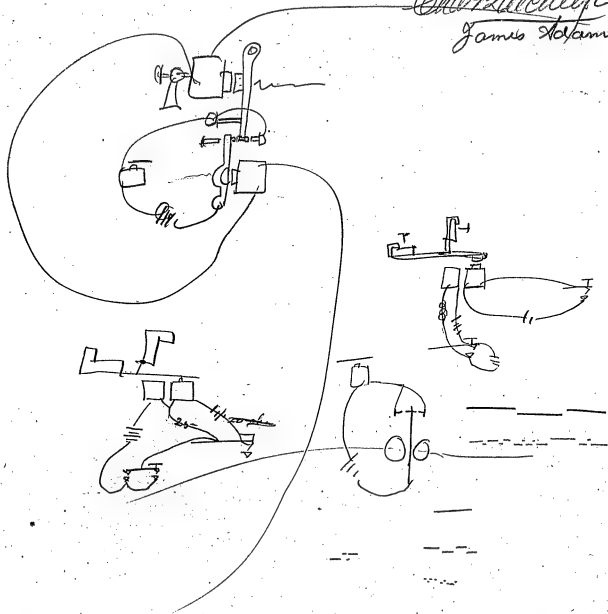
Dr. L. L. L.

April 15 - 1897

Tal. L.

W. L. L.

James Adams

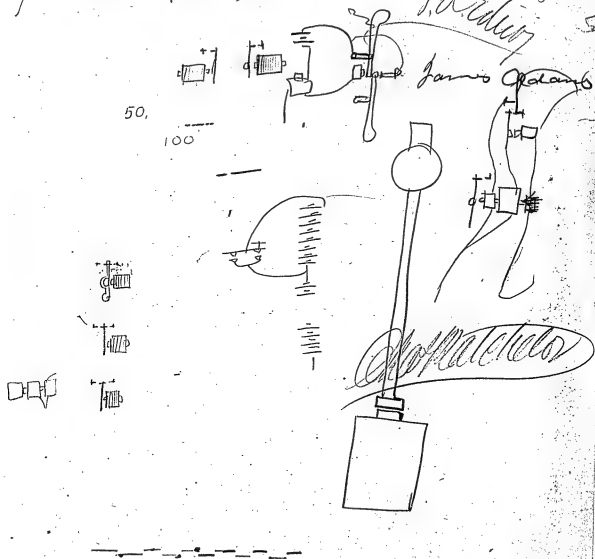


Dexter

April 15 1897

J.W. Edison

James O'Connell

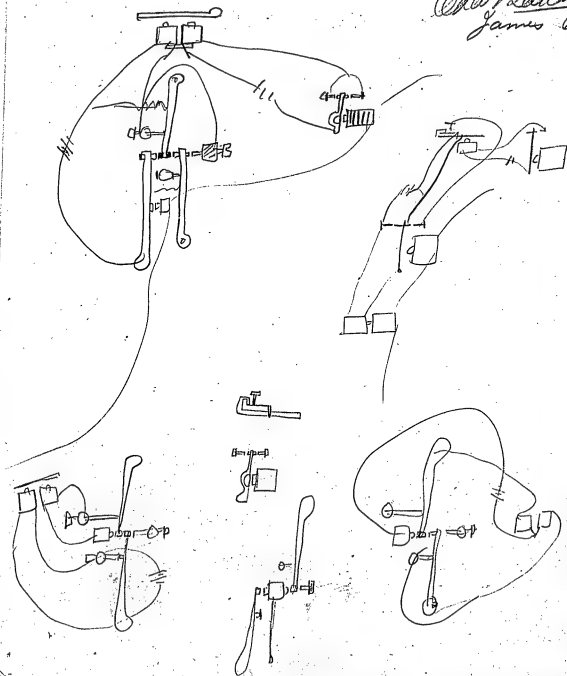


Disturbance -

April 15 1877

T. Edison

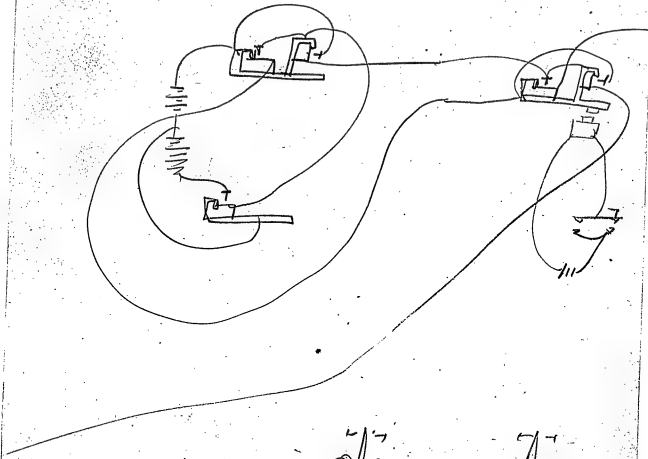
Chas. Batchelor  
James Adams





11

Apr 15th 1877  
Charlat photo  
James A. Adams



o/o

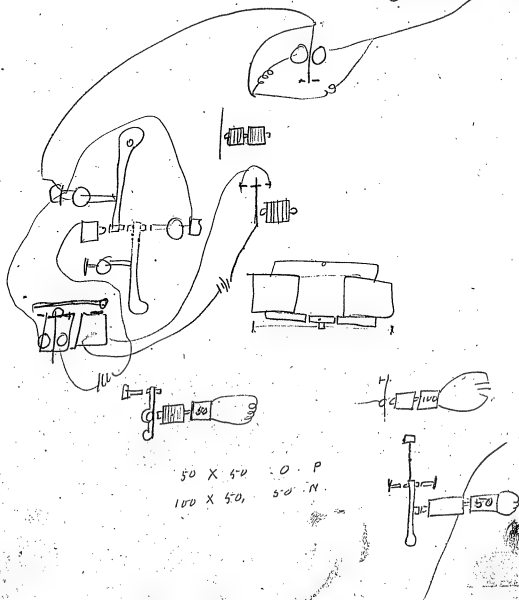
o/o

Strophylax



April 15 1877  
Tadron

James Adams  
Chapman



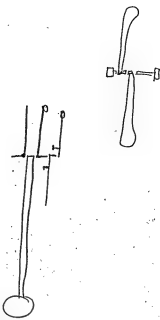
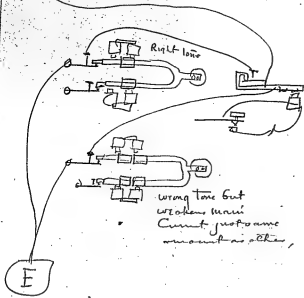
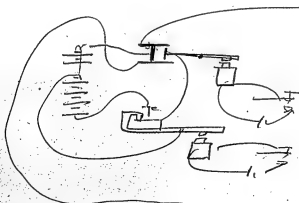
50 X 50 . O . P  
100 X 50, 50 . N

# Septet

April 18 1877

T Edison

James Adams



Outplex =

April 18 1874  
J A Downing

Ja. B. Brown

James Adams

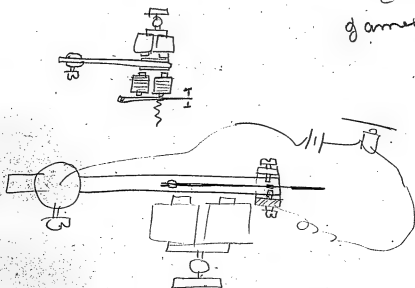
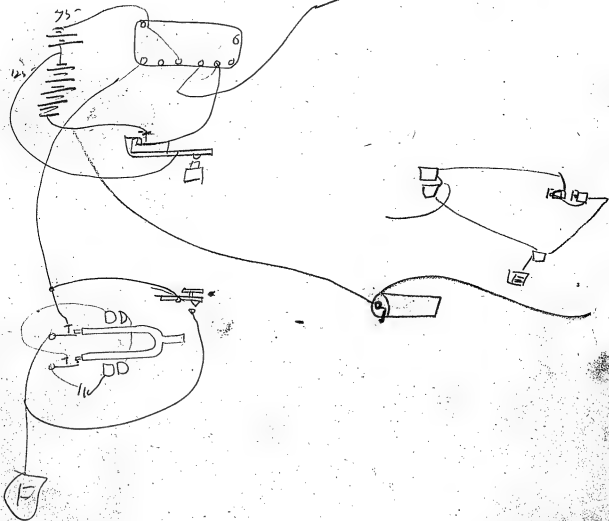


Exhibit  
April 20 1894  
T.C. Adams

James Adams



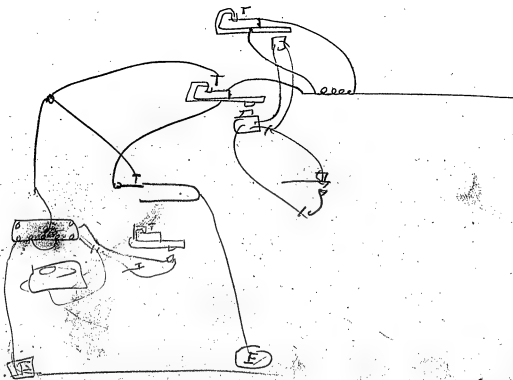
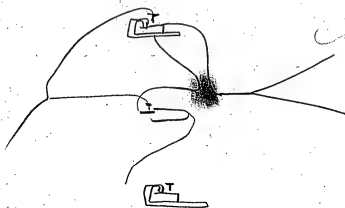
Distplex - ae

April 22 1897

T. A. Edison

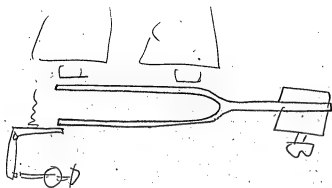
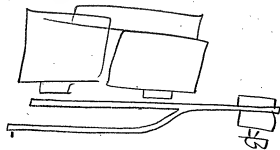
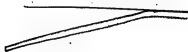
James Adams

*W. H. Ketchum*



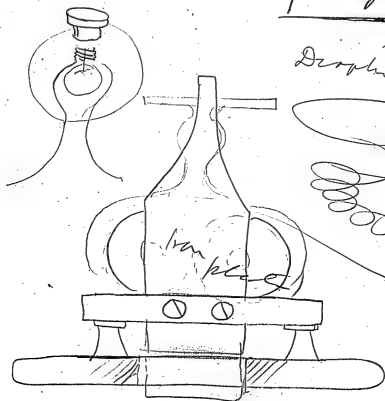
April 22 1875

James Adams

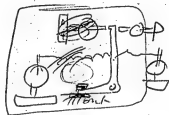
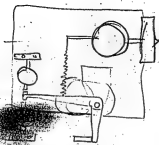


Experiments on - April 22-28 1934  
J. N. Wilson

J. N. Wilson



Spring Balance  
Drop in the  
Brooklyn







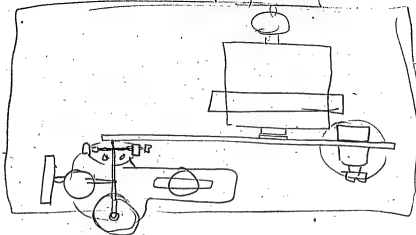
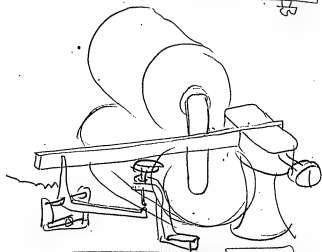
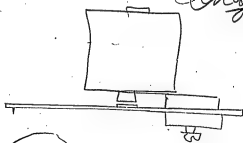
Bextunus

April 23 1877

Ja. Adams

Sketcher

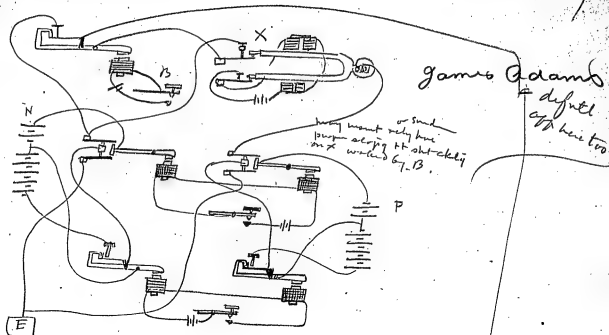
James Adams



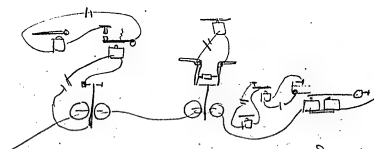
Edison

April 23 1877

J. A. Edison



Bo-fer

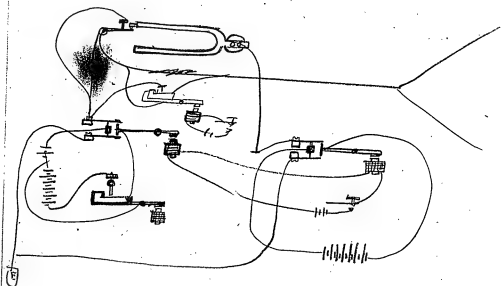


These differential + some send of here

Duplex -

April 23 1877  
J.A. Edison

James Adams



Saturday

April 24 1874

JA Edison

Thomas

James Adams

Thompson

Thomas A Edison



Boston

Boston

Boston



Boston

Boston

Boston



Western

Boston

Western

Boston

Union

Western

Western

Boston

Deityle

April 24. 1877

J. A. Edison

James Adams

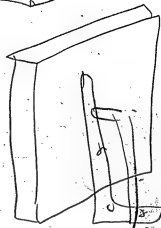
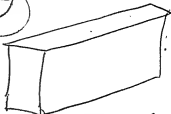


Working foring

Ray Reyn

Has J. Edison

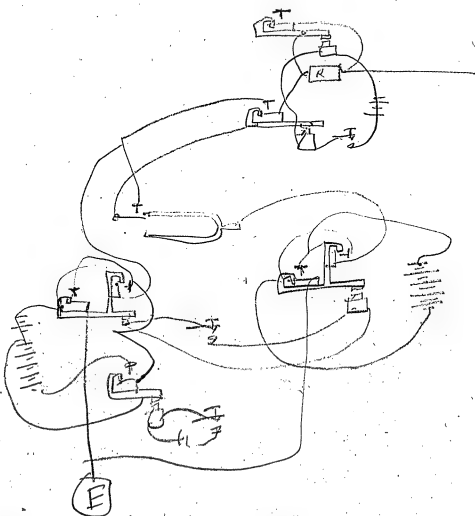
Has J. Edison



Dexhy

April 24 1877  
J A Edison

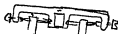
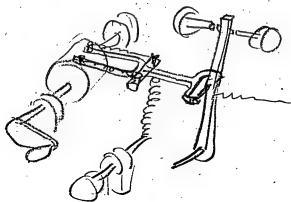
James Adams



Sextuplex  
Emg app

April 27 1877  
J.A. Adams

James Adams



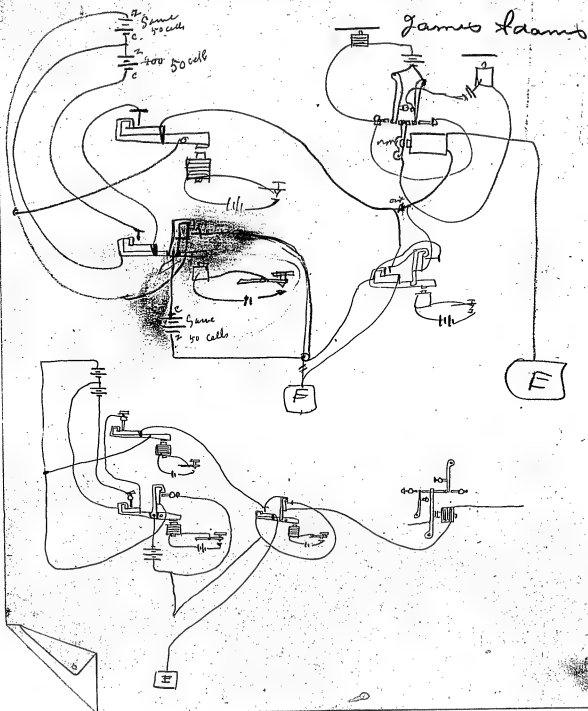
Taking Tel

- |                                      |                   |
|--------------------------------------|-------------------|
| 1 Lamp black                         | Protoxide Nickel  |
| 1 Bone Black                         | Bisulphuret of Cu |
| Bitumen Coal                         | Chromate Copper   |
| Anthracite Coal                      | Paris green       |
| 1 Black oxide Manganese              |                   |
| 1/2 Black oxide Manganese & Plumbago |                   |
| Gold leaf Copper - small disk        |                   |
| Peroxide of Iron =                   |                   |
| acquo oxide of iron                  |                   |



Exclusif

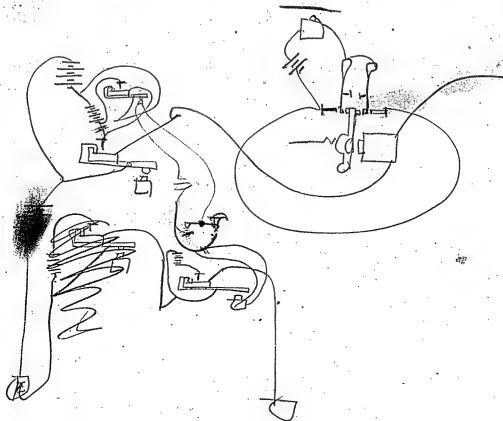
April 27 1877.  
James Lamb



Exduplex

April 27, 1877 =

James Adams

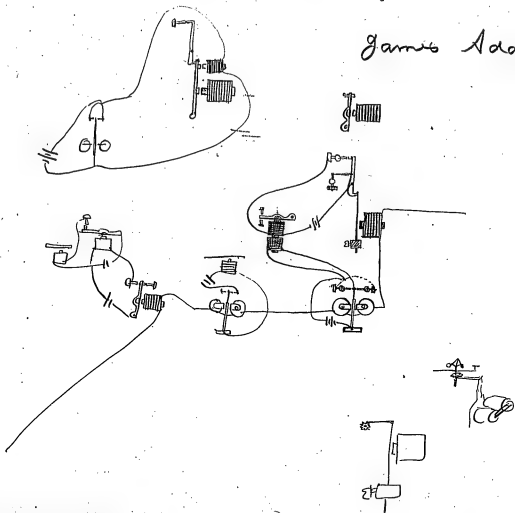


Exhibit

April 28 1879

Edison

James Adams

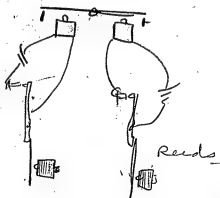


Excerpt

April 28 1877

J. A. Colson

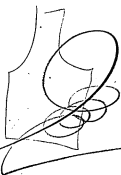
James Adams



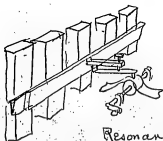
Reeds

156 vib

178, vib



closed 178  
Opt 150 or thereabouts



11 17 Books

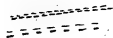
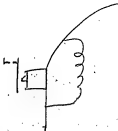
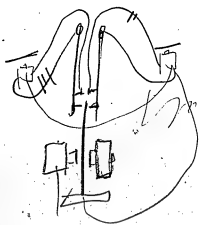
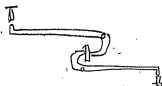
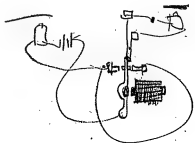
Resonant boxes with diff  
Column air + Eng

Sept 1899

April 20 1899

St. Louis

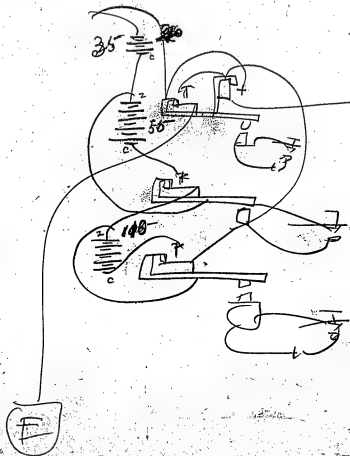
James Adams



9x10x10

April 29 1944  
J. Adams

James Adams

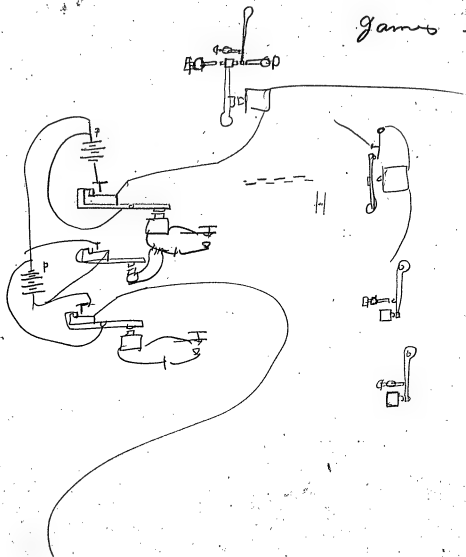


Sketch

April 29 1895

W. Adams

game Adams



*Texting*

Jan 3rd  
*James Adams*  
*James Adams*

Plans of working 3 messages in the same direction  
 for *duplex* working.

{ 1 Reversals 2 Increase + d 3 Increase + d	_____	Polarized relay 50 perm
		Common " 75 inc
		Common " 150 "

{ Reversals Increase + d Acoustic -	_____	Polarized relay 75 perm
		Com " 100 inc
		Acoustic " 65 inc Total

{ Reversals Very small reversals of the 1st 100 reversals; Increase + d	_____	Polarized relay 50 perm
		" or acoustic same

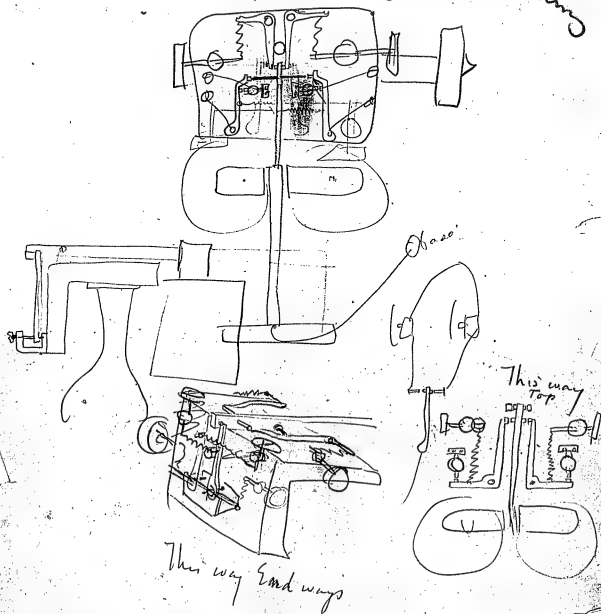
{ 1 Increase + d 2 Increase + d 3 Acoustic	{ 100 rel Com rel Com rel Acoustic, 50 perm	_____

3 increases 50 - 100 - 200 -



D. S. Taylor

May 3 1877  
J. A. Talbot  
~~Chas. B. Talbot~~  
James Adams



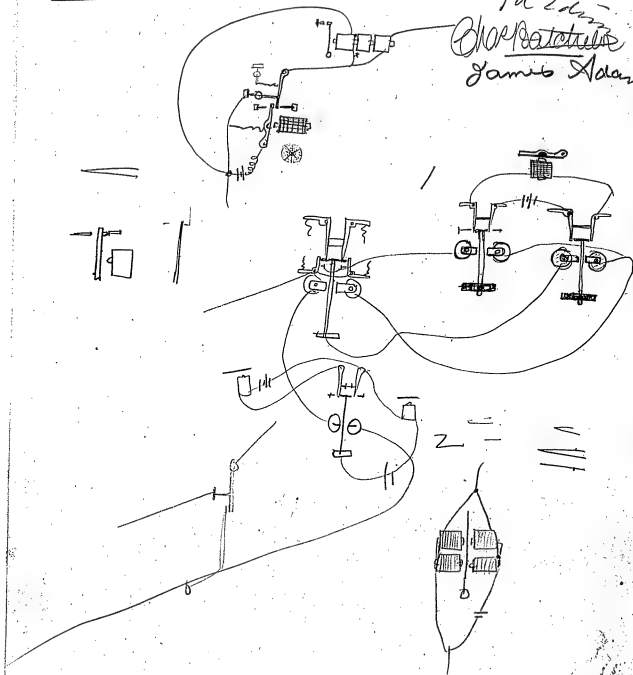
Experiments

May 3 1847

7th Edin-

Chapman

James Adams



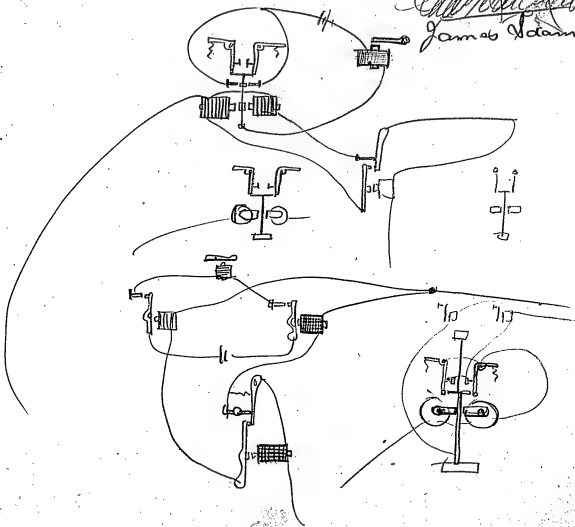
Textus Ex

May 30. 1877

Thos Addison

*Ch. M. Peterson*

James Adam

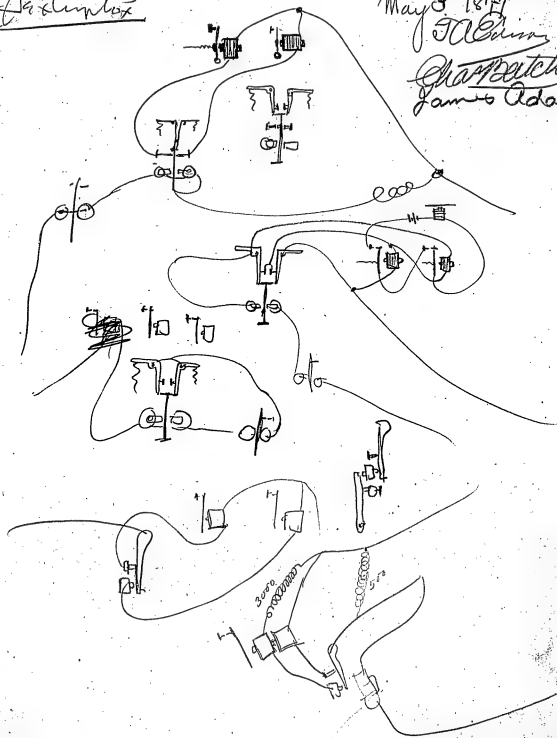


Distinloz

May 3 1874

J. A. Edison

Charlottesville  
James Adams



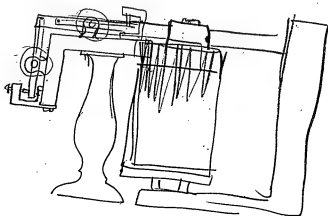
Dituplex

May 3 1897

J A Edson

Chapman

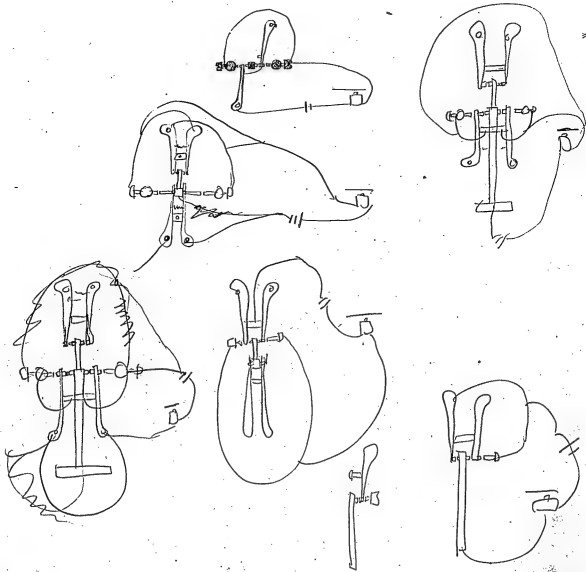
James Adams



Sextuplex

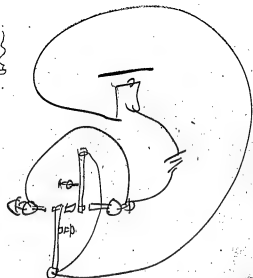
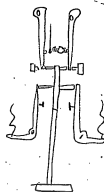
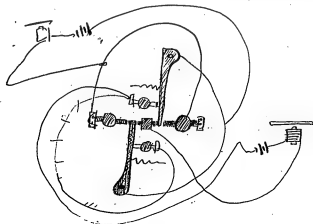
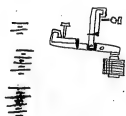
May 6 1877

PA Adams  
*Charles Adams*  
James Adams



May 6 1847

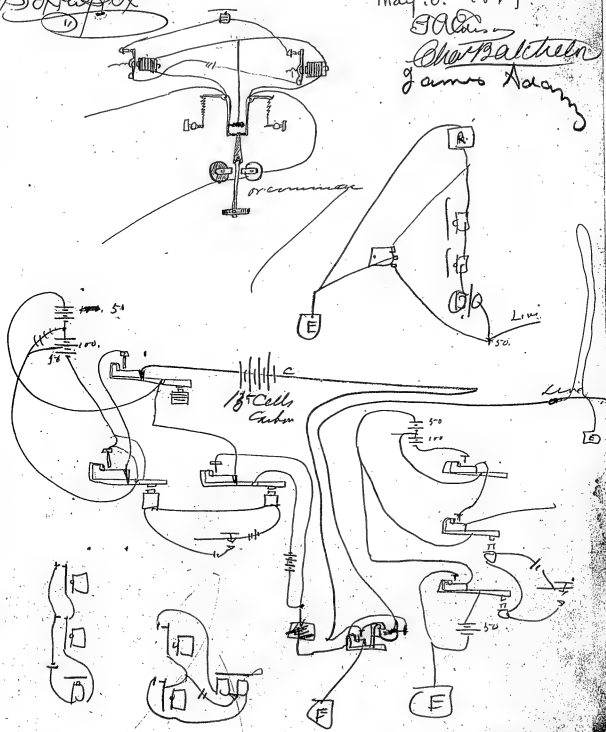
John Adams  
Charles Adams



Box 10

May 6. 1877

Chas. Batchelor  
James Adams

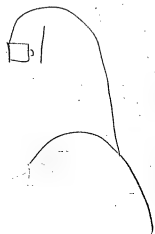
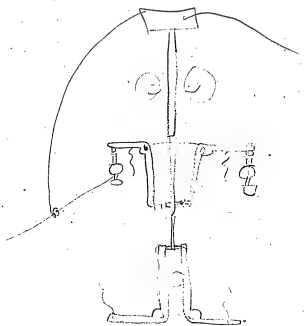




Extuplie

May 6 1897

J.A.E.  
Chas. S. Adams  
James Adams

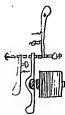
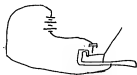
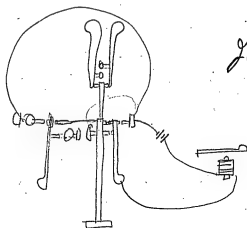


Sextuplex

May 6 1877

J.A. Adams  
~~Charles Beckwith~~

James Adams



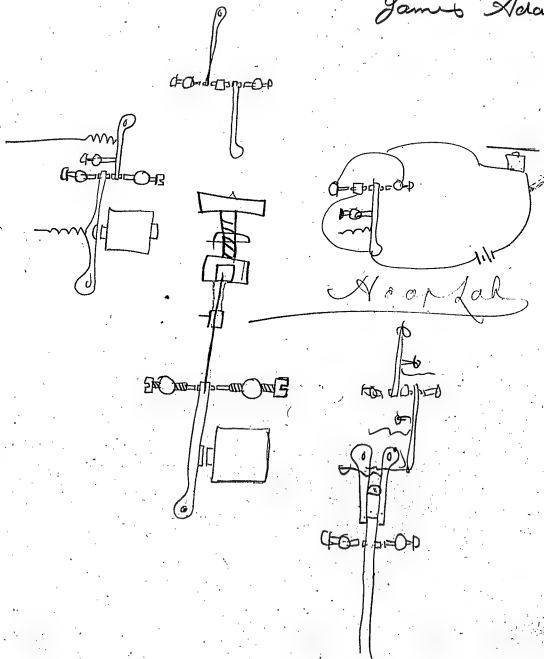
Duplex

May 8. 1877

J Adams

~~Chas Adams~~

J Adams

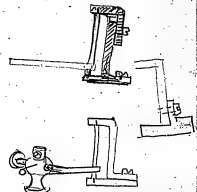
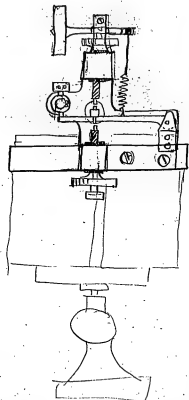


Secretary

May 8<sup>th</sup> 1877

James Adams

Chapman & Co.

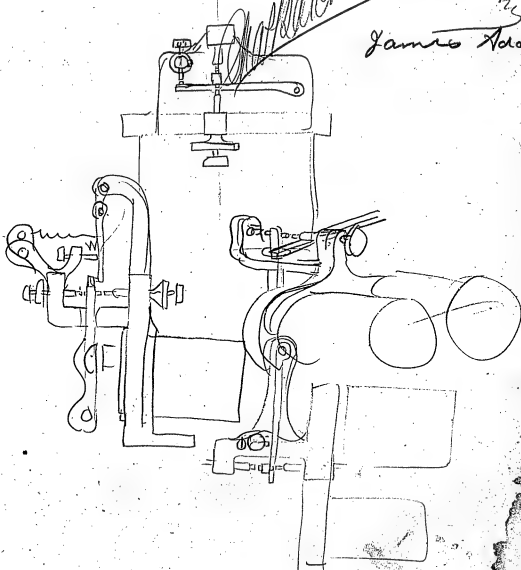


Erstling

May 8<sup>th</sup> 1877

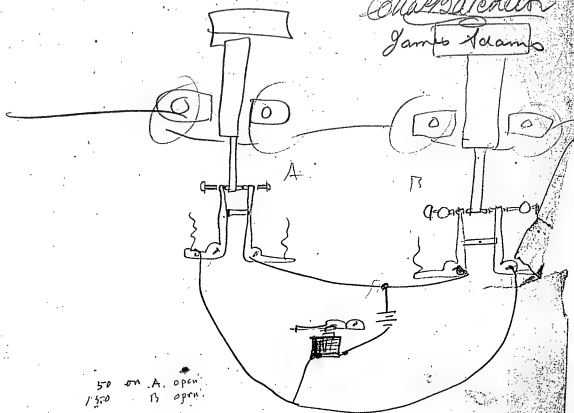
Matchless

James Adams



Sketching

May 8 1877  
J.A.S. drawing  
Chas. B. Batcher  
James Adams

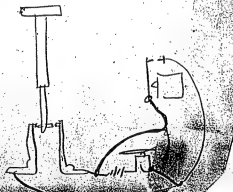


50 on A. open  
150 on B open  
50 off

50 off: A open  
150 on: B open

50 on: A open  
100 on: B closed

00 on: A closed  
150 on: B open

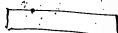
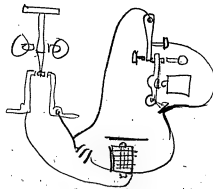
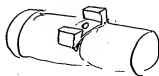
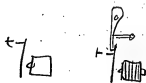


Textures =

May 9 1877

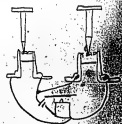
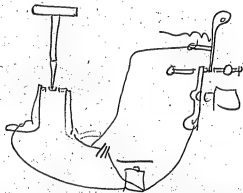
J. A. Ewing

James Adams  
Cha. Patchen



10. 2

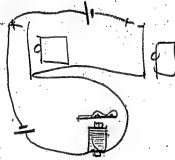
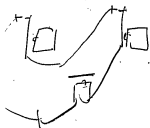
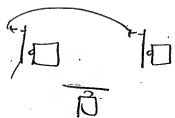
5. 1



Experiments

May 9<sup>th</sup> 1847

J. Adams  
~~John Adams~~  
James Adams





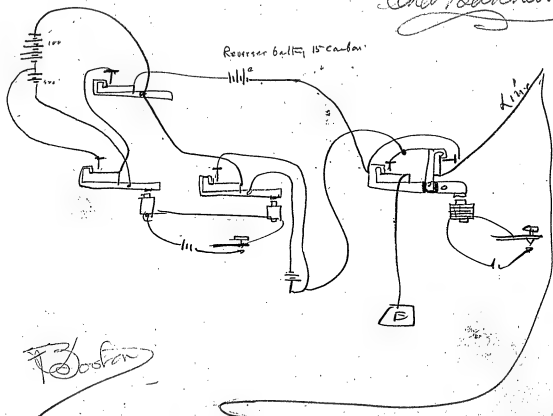
Stimpert

May 9. 1877

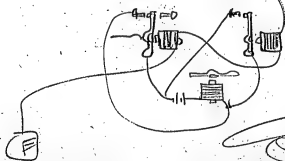
J A Edison

James Adams

Chas. Batchelor



Boon



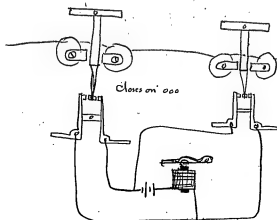
Mistake  
Reading not all  
only for Defective

Septuor.

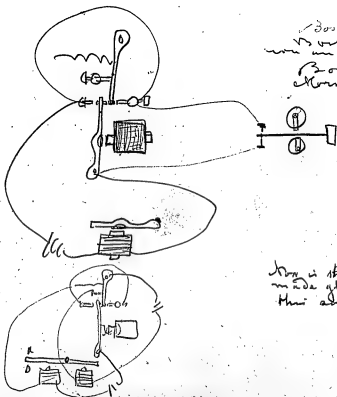
May 9 1877.

76  
Chas. Bachelon  
7877

James Adams



closes on 100 + 00 but not on 150,



Boston Boston  
Boston Boston  
Boston Boston  
Boston Boston

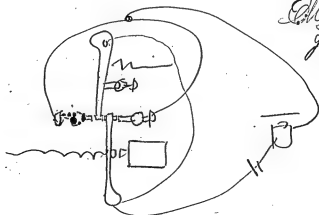
Key is the number of one diameter  
made aluminum aluminum of  
this also of work 804

Centuplex

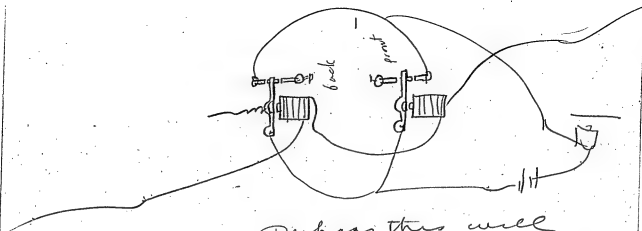
May 9 1897

J. A. Dawson

Chas. Batchelor  
James Adams



This works about same as the lever in  
front. perhaps not quite so well.



perhaps this will  
replace -

works well.  
perhaps better than lever  
relay.

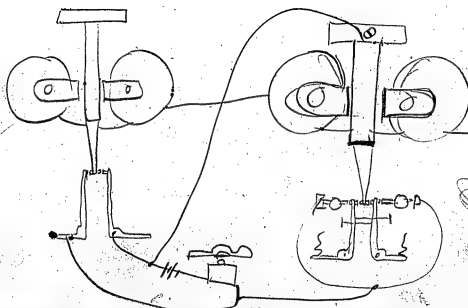
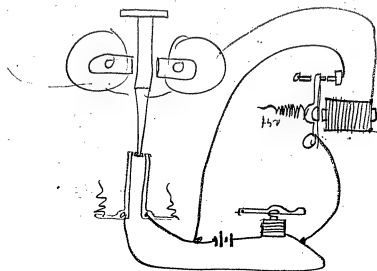
Dextrophor

May 9, 1879

5A Chicago

Chas. Batchelor

James Adams



Line  
or bridge

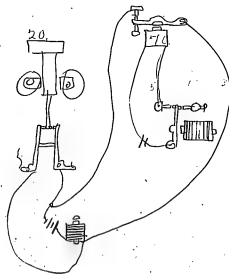
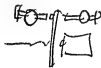
Drop

*Disturbance*

May 9 1877

J. A. Cairns

James Adams  
Chas. D. Hutchins

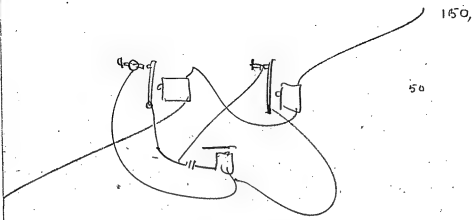
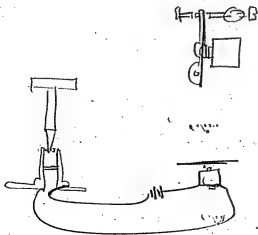


May 9 1847

5th Edition

Charles Babbage

James Adams

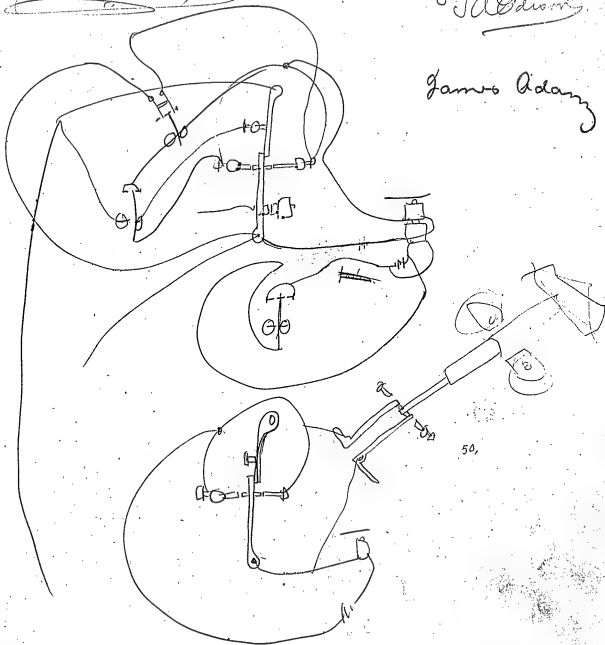


Duplex

May 9 1877

J. A. Edison

James Adams



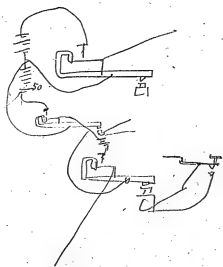
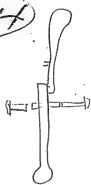
50.

Sept 1877

May 9 1877

J. A. Johnson

James Adams



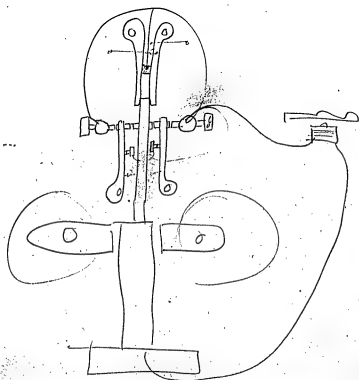
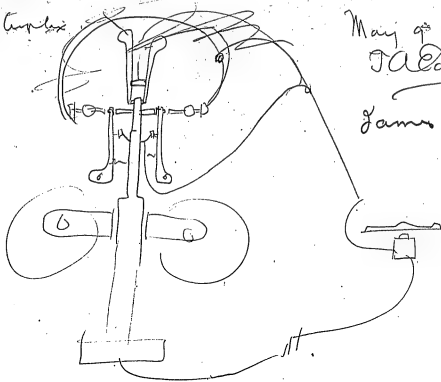


Exhibitor

May 9<sup>th</sup> 1877

Edison

James A. Swan



Textuplex

25 -

50,

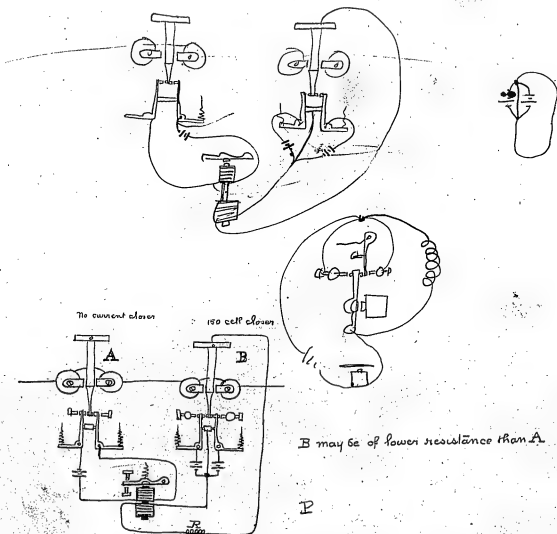
25,

May 10 1877

J. A. Edison

Chas B. Batchelor

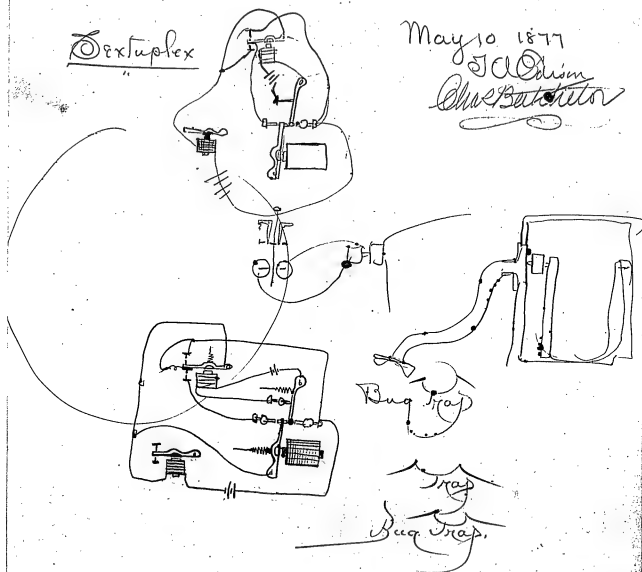
James Adams



Dextuplex

May 10 1877

J. A. Quinn  
Chas. B. Eaton

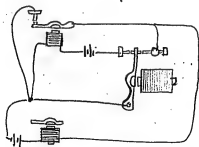


Bug trap Bug trap

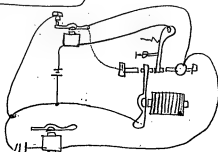
Textuplex

May 10 1877

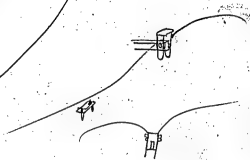
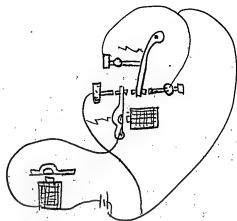
J. Adams  
~~James Adams~~  
 James Adams



good bug trap for reversals for Quad



Bug trap for "Text"

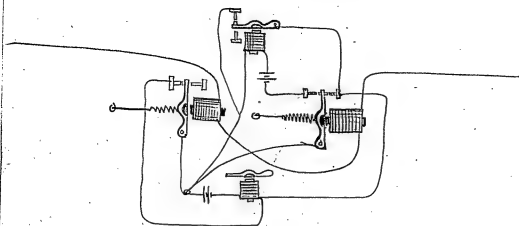
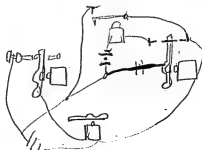


Stuplex

May 10 1877

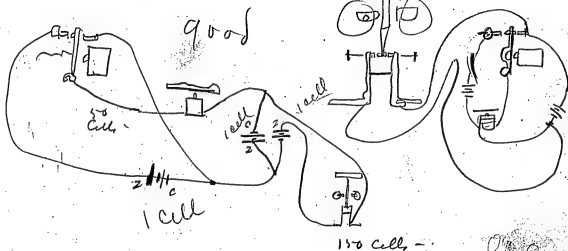
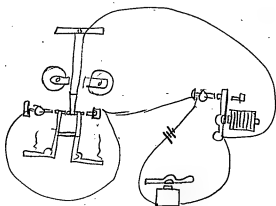
Falmer

Chas. Balch



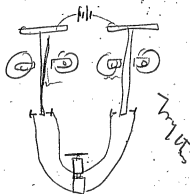
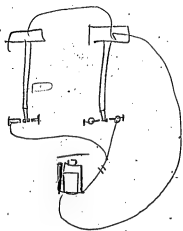
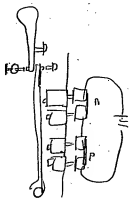
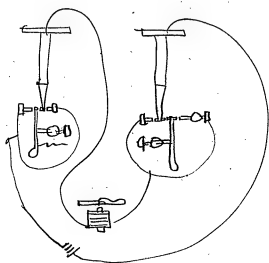
# Sextuplex

May 10 1877  
J A Edison  
Charlebatcher



Dextuplex

May 10 1877  
J.A. Edison  
Chas. Batchelor



Textuslex

May 10 1897

Margin for  $\phi$  with 50 cells.

J. A. L. H.

for A ~~25~~ 25 to 75 Chas. Batchelor

A. 50 constant; B closed 150, margin for 100.  
30 Constant B "

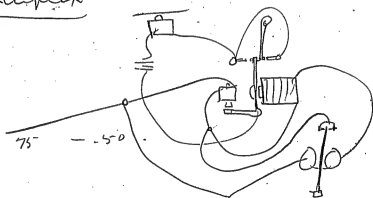
with A on or off. B works either with a 150 or a 100,  
if B has on 30 cells,

100, 200,



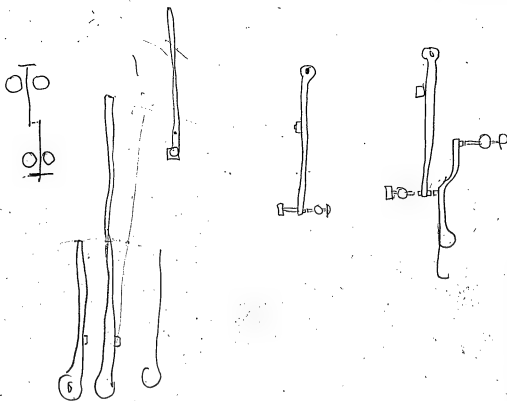
Bentuplex

May 10  
1897



J. A. Edm  
Chas. Satchel  
James Adams  
Bentuplex

70. place 50 1st Transmitter  
80 Cells, place 100.



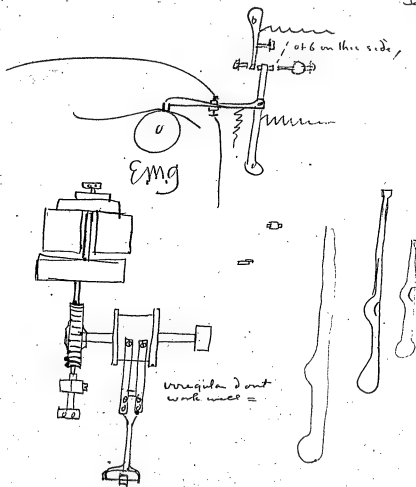
1

Sextuplex -

May 10 1977

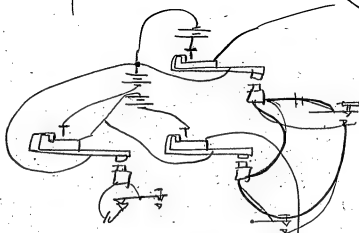
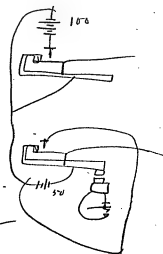
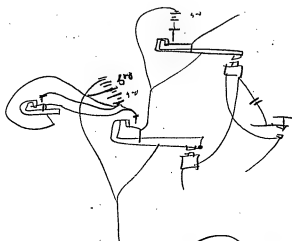
JA Edison

Chas. R. Ketchum



Dextuplex

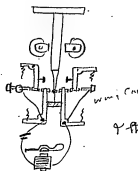
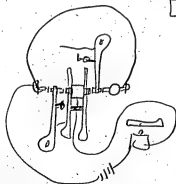
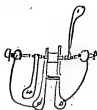
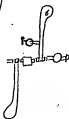
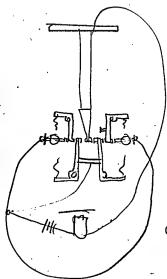
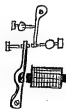
March 10 1897  
J. A. L.  
Charles A. L.



Sextuplex

May 10 1877

JA Edison  
Chas Batehn



I think this is good

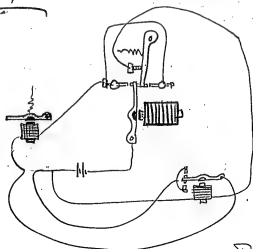


Testuplex

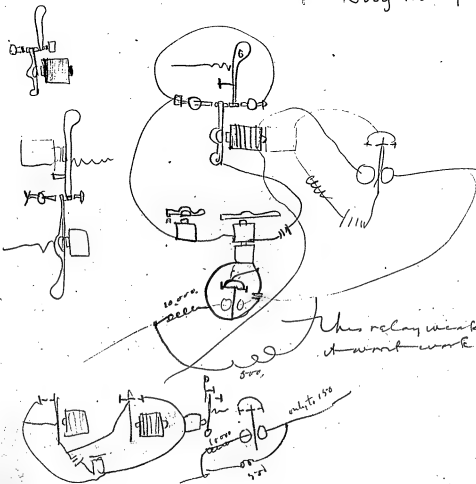
May 10 1897

J. A. Edison

Chas. Batchelor



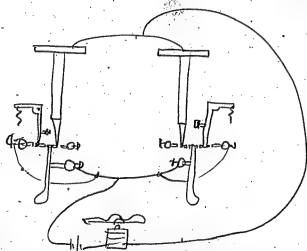
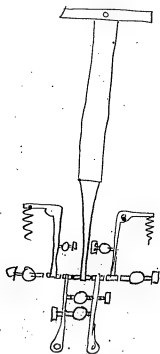
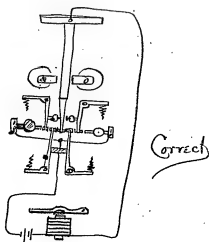
Boag Trahop



Textuplex.

May 10 1877.

J. A. Edison  
Chas. B. Atchley



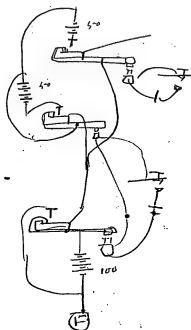
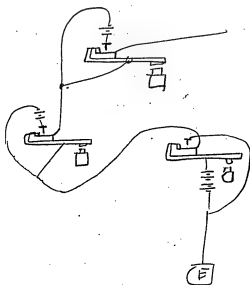
Dextuplex

-50  
50.

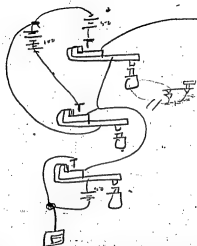
100.

May 10. 1877

Thos A. Graham  
Charles Batchelor



Wentworth



150  
50  
100

250

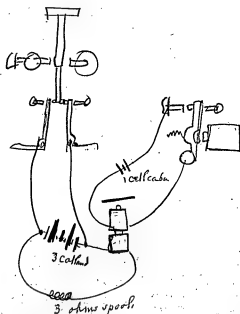
16

150  
50  
50  
50  
250

Orsty

May 14 1877

J A Edison  
Chas Batchelor  
James Holmes

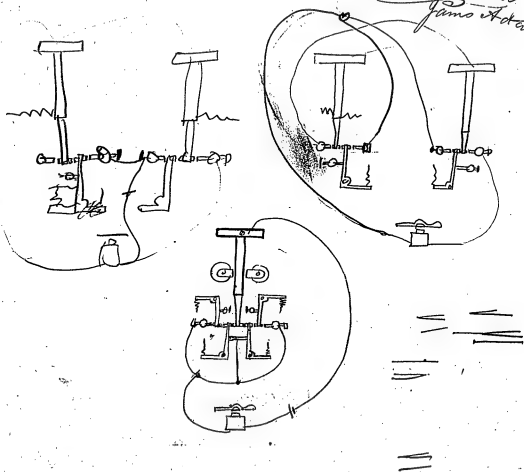




6x10x10

May 11 1897

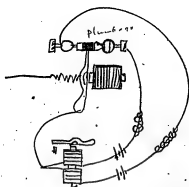
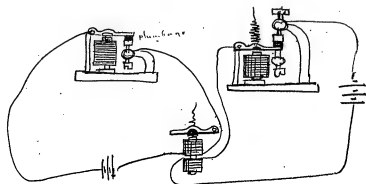
J A Elin  
Chas. Katchela  
Jamo Adamo



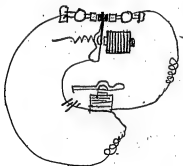
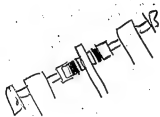
Dextuplex

May 11 1877

T. A. Edison  
Charleston



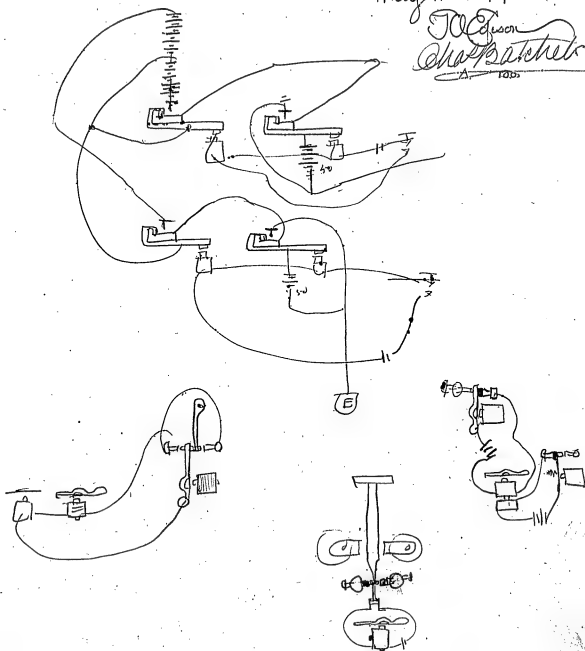
Reserve Key



Hexuplex

May 11 1877

J. A. Edison  
Chas. Batchelor

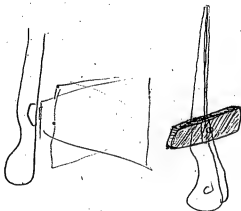
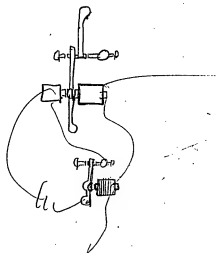
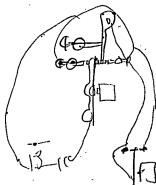
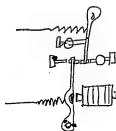
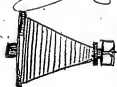


Textbook

May 11 1877

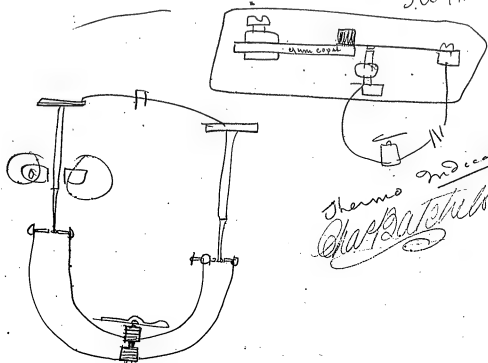
5a Edison

Chas. Batchelor

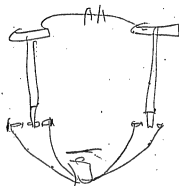


Orthoscope & Thermo indicator

May 11 1877  
J. A. G. M. M.



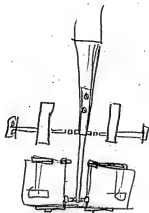
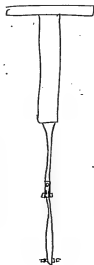
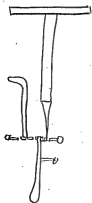
Thermo indicator  
Chapman



May 11 1877

J. A. B. Smith

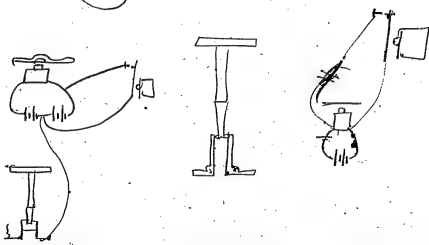
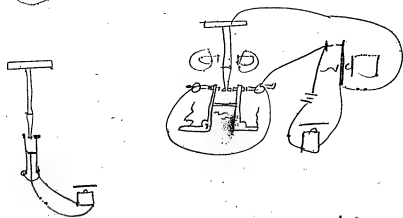
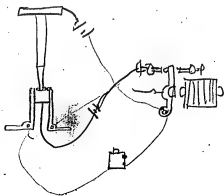
Chaetopterus



Dr. C. W. C.

May 12 1877

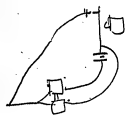
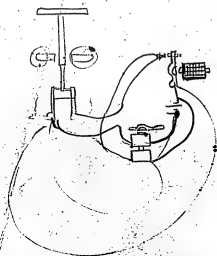
J. A. Edison  
Chas. B. C. C.



Experiment

May 12 1877

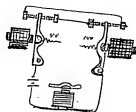
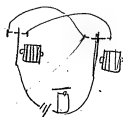
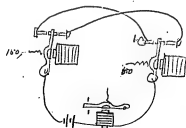
J A Edison  
Chas Batchelor



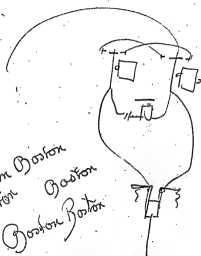


Examples

May 13 1877  
J. A. Edison  
Chas. S. Smith



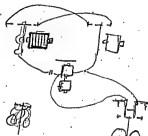
This works the best of all.  
Reversals and the 100 @ 50 man (claw)  
don't thrill it enough to prevent from  
signaling.



Boston Boston Boston  
Boston Boston Boston  
Boston Boston Boston

Try

Try

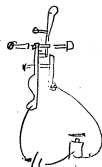
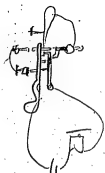
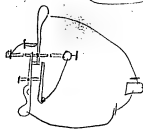
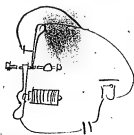


*Bistuplex*

May 13, 1877

J.A. Edison

*W. A. Batchelor*

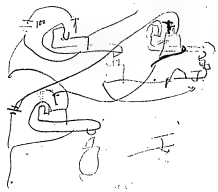
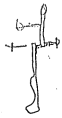


Satchel

May 13 1847

J. A. S. King

Wm. Satchel



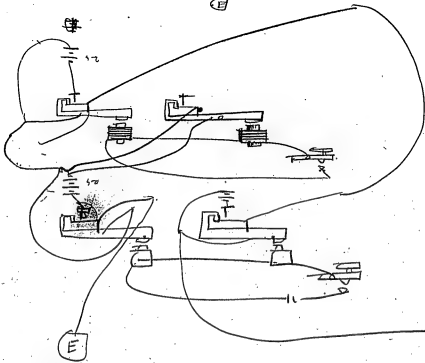
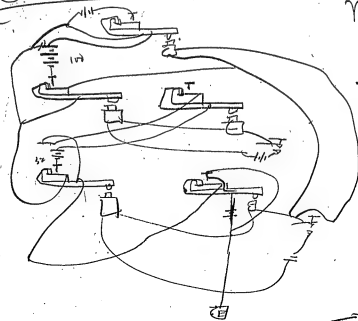
duplex

May 13 1877

Salisbury

~~Charles~~ Satchels

James Adams

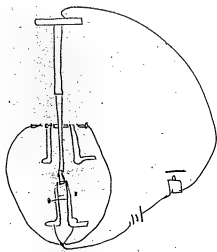


Line

Sextuplet

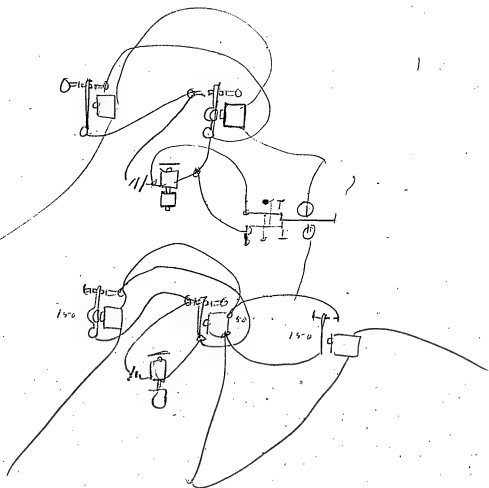
May 13 1877

Ta Edison  
Chattanooga



Duplex

May 13 1877  
J. A. Edison  
Chapatcheto



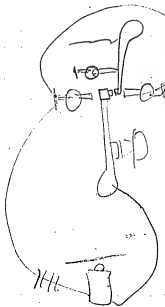
Enslupher

May 13 1877

T. Adams

Wm. B. Batchelor

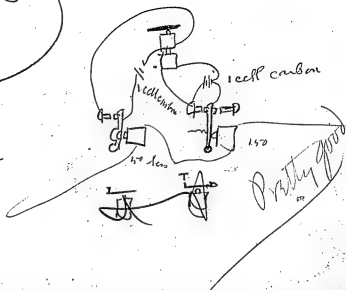
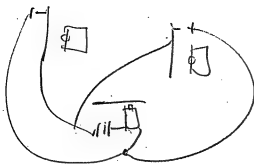
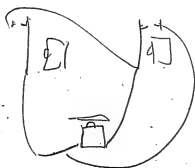
James Adams



Baxendale

May 13 1877

J.A. Adams  
~~Charles~~ Batchelor  
James Adams



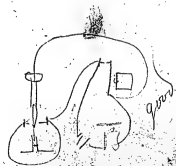
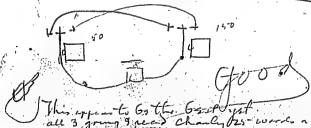
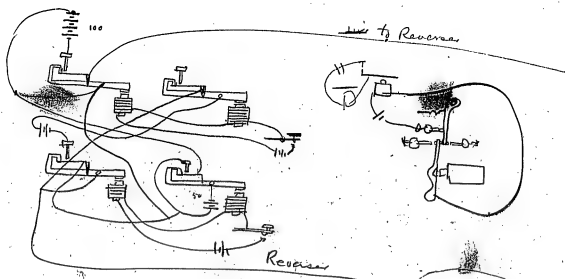
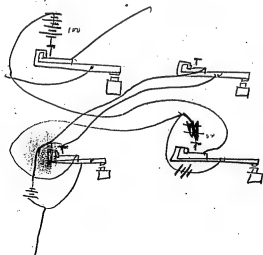


*Duplex*

May 13 1877

J. A. Edison

*Chat Batcher*  
James Adams.



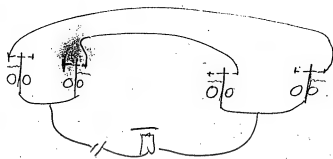
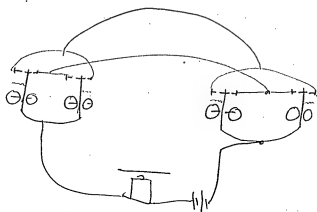
This appears to be the best yet  
all 3 using 3 sets of Chandler's words a  
minute little variation

May 14 1877

T. A. Edison

diagram

Edison





*Textuplex*

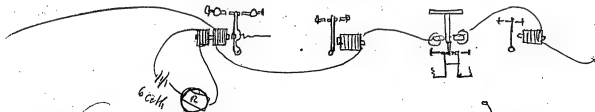
W. A. Edison

PTC  
Tadorn

J. A. Edison

May 14 1877

disou



~~The A. Edinboro~~  
~~Wm. A. Edinboro~~ ~~The A. Edinboro~~  
~~M. A. Edinboro~~ ~~M. A. Edinboro~~  
~~Wm. A. Edinboro~~

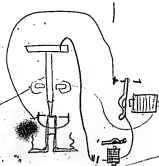
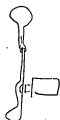
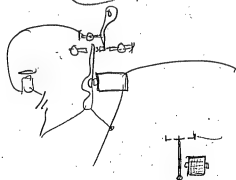
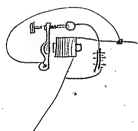
*W. B. Peters*

Wm. Crten

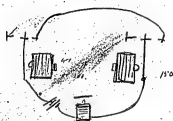
Dextuplex

May 14 1877

J. A. Brown  
Rev. Batcher



yes splendid bug catcher  
I think it good



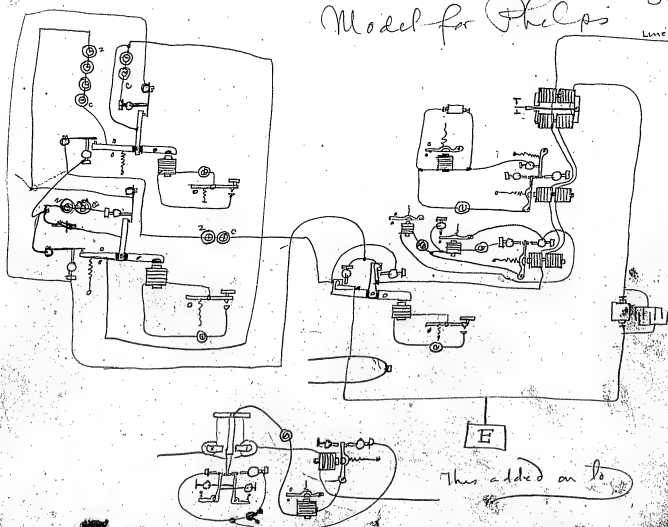
Dextuplex

Sketch

Sextuplex May 14 1877

Model for Phelps

3rd Edition



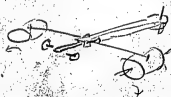
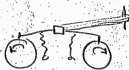
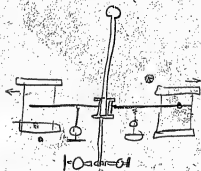
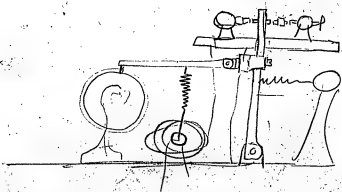
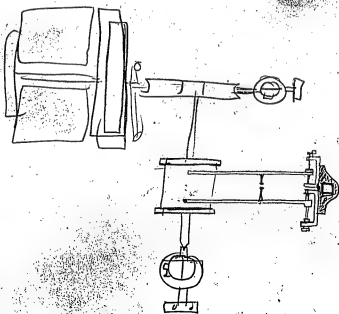
Stetplex

May 14 1877

T. A. Edison

Dated May 19th 1877

W. B. Chalmers

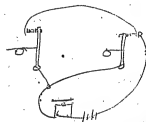
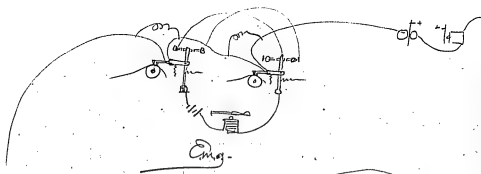
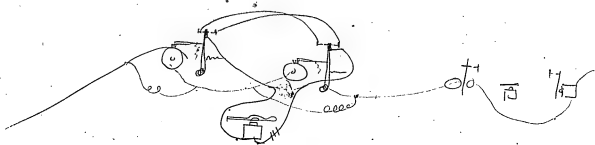


11/4  
109

*Diagram*

May 14 1877

*J. Adams*  
*Charles Adams*  
*James Adams*

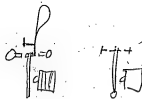
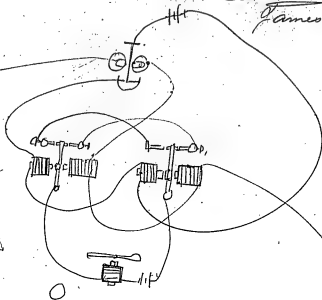
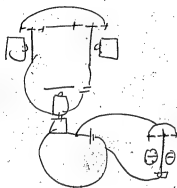
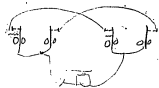
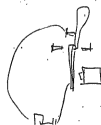




*Duplex*

May 14 1877

*W. A. Edison*  
*Chas. Batchelor*  
*James Adams*

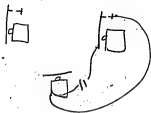


Try this

Septuplex.

May 14 1877

J. A. Edison  
Charles Batchelor  
James Adams

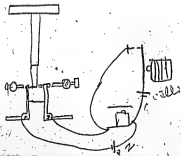
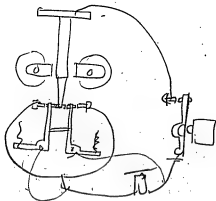
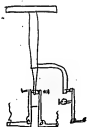


Setty

May 14 1877

7 a.m.

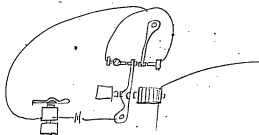
Chas. B. Felt  
James Adams



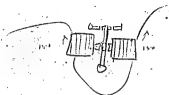
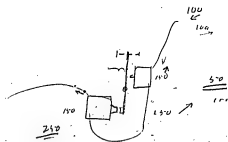
# Stetplex

May 14, 1877

F. A. Brown  
 Chas. B. Brown  
 James Adams



00



300,

30,

30

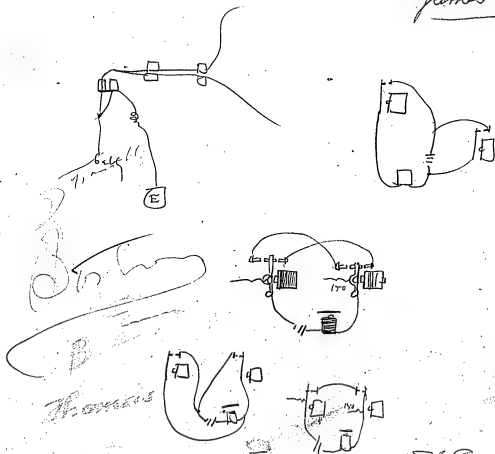
Duplex

May 18 1877

go flys back to head into short.  
for clearing And Reversal

Chas. Batchelor

James Adams



Thomas Edison

Thomas Edison

1877  
from Batchelor

*Explicit*

*DeLong*

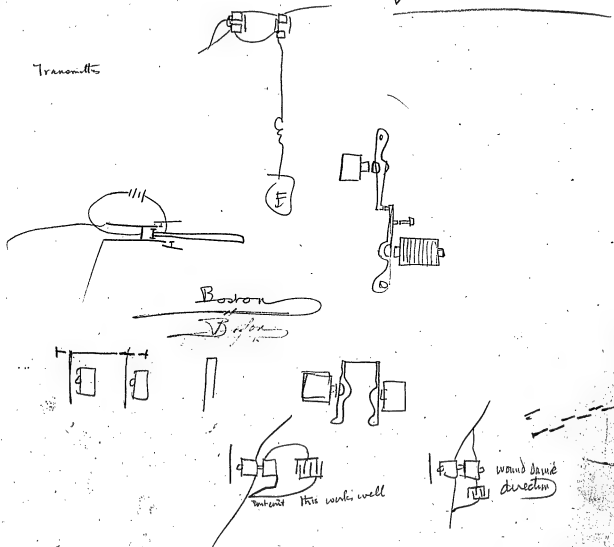
May 18 1877

SA Edison

Charles Batchelor  
James Adams

James Adams

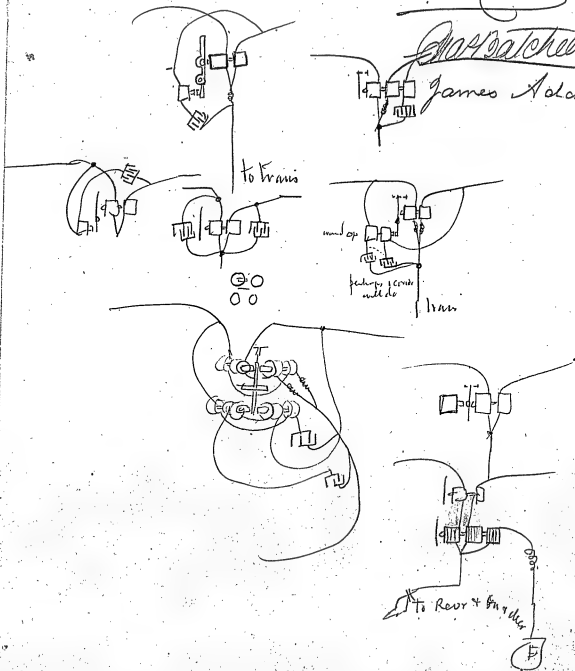
Transmittes



Sketches  
Competition

May 18 1877  
J. A. L. L.

James Adams



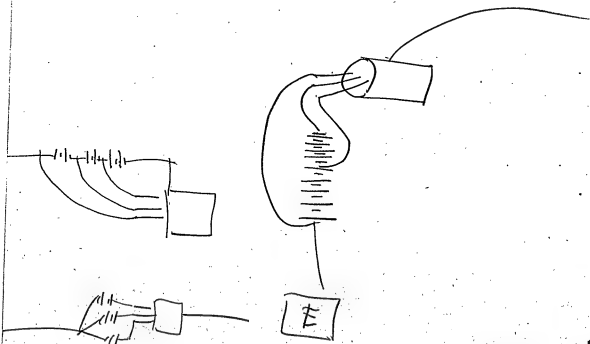
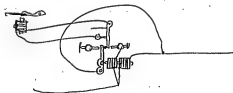
Stentor

May 18 1877

Tellur

Chapman

James Adams



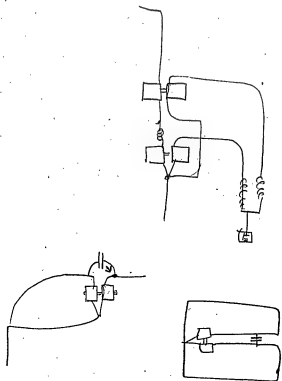


Seetuplex

May 18 1877

FaEdway

James Adams

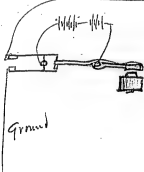


Inductance

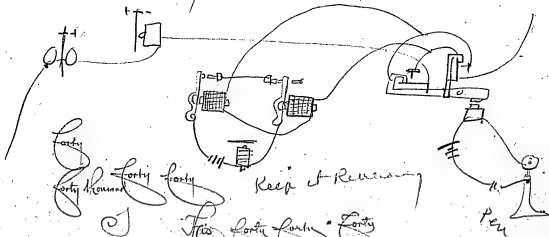
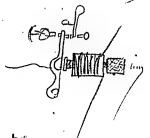
Line

May 19, 1877

W. L. G.



James Adams



Forty

Forty

Forty

Forty

Forty

Forty

Forty

Forty

Forty

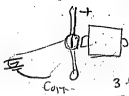
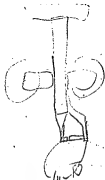
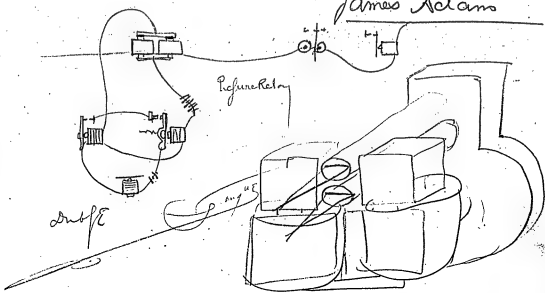
Field Station

Forty thousand dollars received for you

Teleplex

May 19 1877

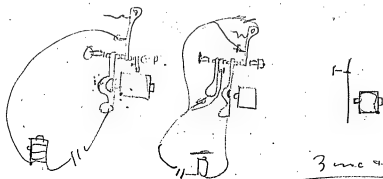
James Adams



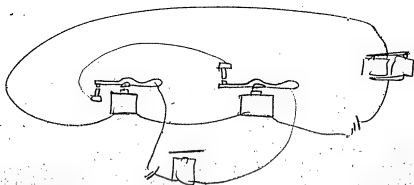
3 layers sound wire  
2 cells carbon; not  
shy w/ with  
100 cells = 4600  
ohms

May 19 1877

J. A. Edison



3 inc + dec no Res

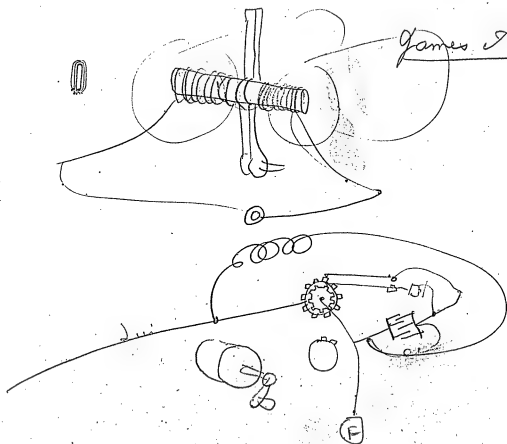


Teduplex

May 19 1877

J. Adams

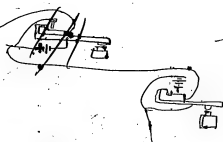
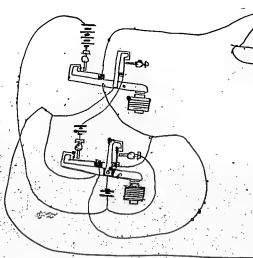
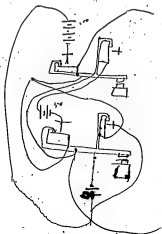
James Adams



Sketch

May 20 1877

To C. A. Smith  
Charles Satchel  
James Adams



17/10/77

17/10/77

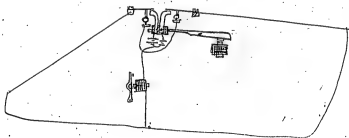
17/10/77

Quail & J. & G.

May 24 1877

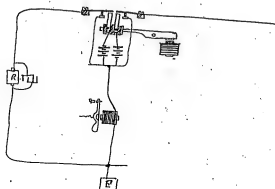
J. Adams

*Chas. Adams*  
James Adams

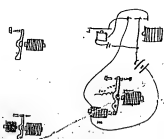


Principle of balancing in  
 the Quad & Septuple Transmitters  
 without bridge & differential

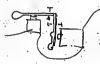
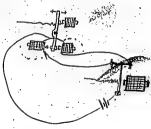
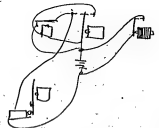
May 24 1879  
 J A Edson  
 Chas Batchelor  
 James Adams



Inductor of Hg. Inductor in  
 replace Fleming, in  
 Ticker & Telph - 9 notes damp  
 accompanied with explanation  
 on Com. 40 all called  
 to hand printed paper =



Septuple

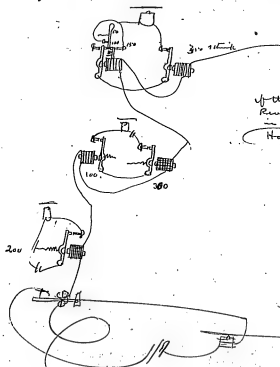




Dechipher  
without reversals  
3 magnetic diagrams

may 25-1877  
J.A. Adams

James Adams  
Chas. Patchen



If the wind with old and  
Reverse the whole  
in Dechipher No. of file  
How the actual change

300  
100  
100  
400  
700

1000  
1000  
1000  
1000  
1000

1000  
1000  
1000  
1000  
1000

1000  
1000  
1000  
1000  
1000

1000  
1000  
1000  
1000  
1000

John Bayley  
Boston

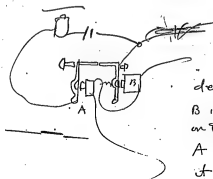
50  
50  
50  
50  
50

50  
50  
50  
50  
50

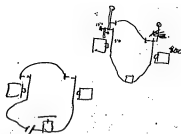
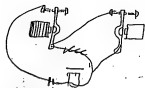
*Endeavour*

May 25 1897

J.A. Adams  
 Charles Adelphi  
 James Adams



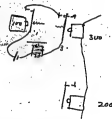
device for reversing thro A & B  
 B is adjusted to stay closed  
 on the permanent current.  
 A to close on the main  
 it close local through  
 lens of B when at the  
 moment of reversal of the  
 back with the lens of A  
 and then prevents the  
 local current from being  
 broken



50. 0

100 - 125

205

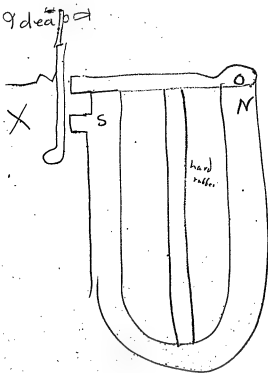


Discovery

May 26 - 1877

If you look very closely at any printed matter so that the print is greatly blurred and you see double images of the type and one of the double images is always blue or ultra violet =

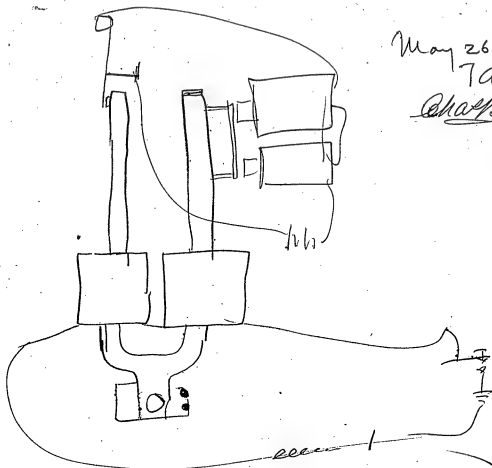
good & cheap



Chas. B. Batcher

Expansion causes free  
poles at X & attraction  
magnet.  
this idea may be  
carried out in many  
ways =

May 26 1877  
T A Edison  
Chapman

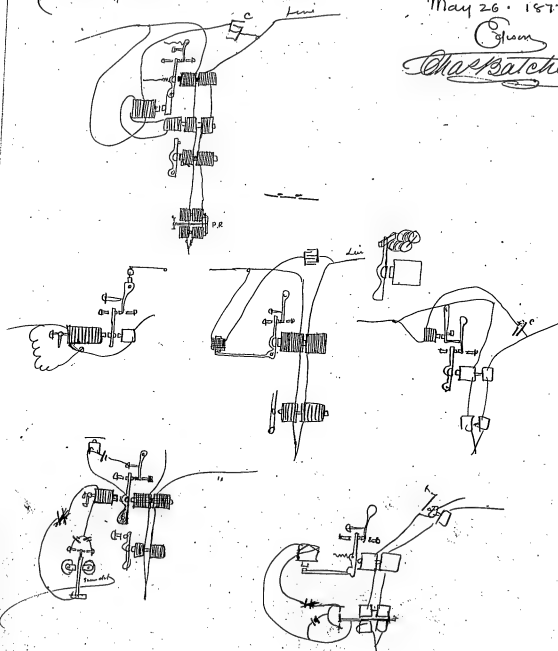


Magnetizing the shank alter the time and  
you need of the Morse = might have  
a 1/2 dozen - and arrange that while  
one wound alter its time to a 60th, one  
the effect of the other would be to  
make ~~down~~ up or Power Multiple

Exampler

May 26 • 1877

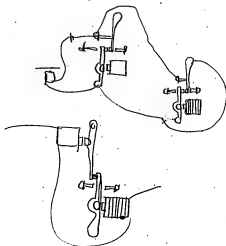
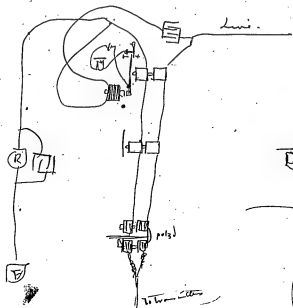
Edison  
Chas Batchelor



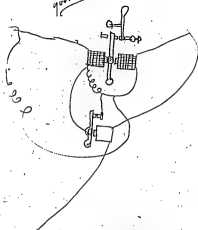
Experiments

May 26 1877

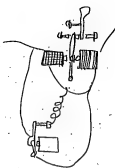
Edison  
Charles Batchelor



good I think



00



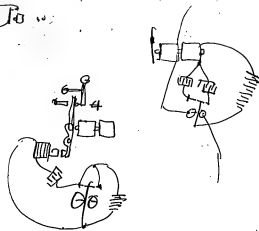
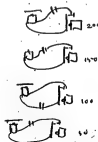
Experiments

13

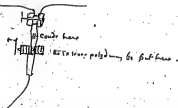
May 26 1877

JA. C. C.

Chas. B. C.



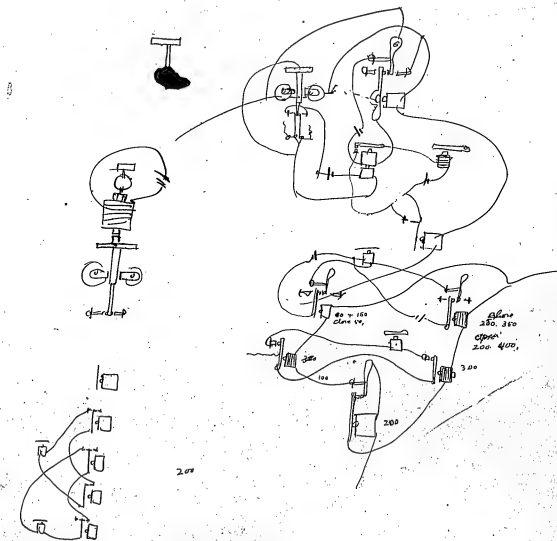
Think in Quad its best not to take compensate  
for the polarized relay in the effect of  
taking of 6 & pulling in the Extra Battery  
is to nullify the Reverse signal  
how it



Duplex

May 26 1877

Edison  
Charleston





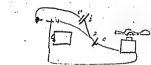


Seetuplex

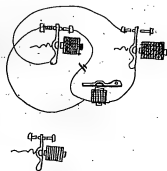
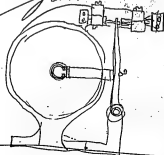
May 30 1877

JaLan

James Adams



June 3rd. 1877  
JaL

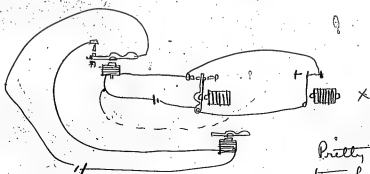


00

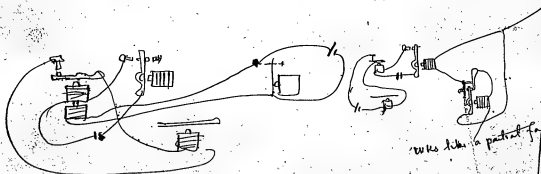


Sooty-throated

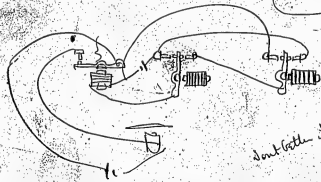
June 1 1897  
J. A. Baird



Pretty fair but reversals  
touch X



works like a packet of

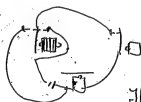


and better of much

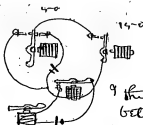
Duplex

June 1 1887

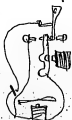
Edison



This works splendid  
Scarcely a bug in it  
Besides its very simple

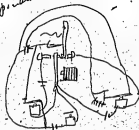


I think a repeating sound  
better & put in as many to  
150 reg. wavy sound not  
shunted gives light sound  
when in 50 shunting sound  
in writing comes heavy hence  
although no "dags" that wavy  
would be uneven by reason

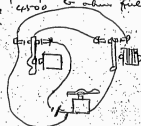


Try this

Not very good  
Can't make enough  
adjustment without  
pulling electric



of def. Great strength produced  
the sound the Royal  
Sound covered a bushy tree  
I put repeating sound in but it gave  
like I then put in Duplex 100 sound  
which worked better scarcely bug but  
it is great if any input on straight sound  
with static off this 4400 G. when full ends  
it works quite even  
I must write  
Scarcely a bug =

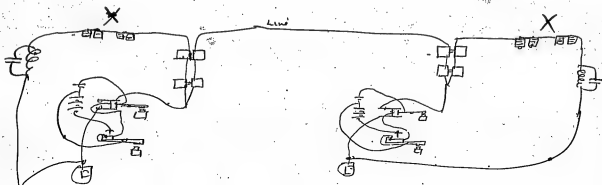


Putting G. in dub-  
appears to make it  
any better =

Detuplex

June 1, 1897.

McGraw

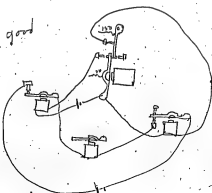


The object of the Electromagnets X at both ends is to create the same conditions upon the artificial as there is on the line, and it is impossible to obtain an accurate balance unless the 2 relays of X are inserted to counteract the effect of the 2 receiving relays at the other station & vice versa =

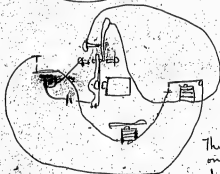
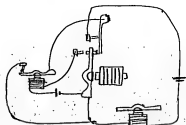
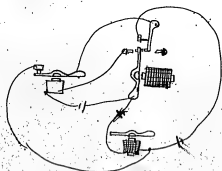
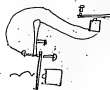
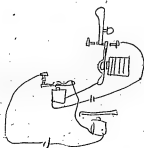
Dextuplex

June 1 1897

Edison



This don't appear  
to work very well  
although the reverse  
don't effect No 2 100 work  
does

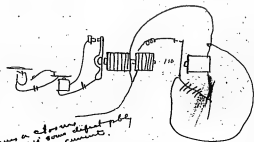
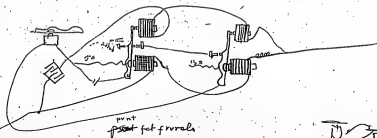


This appears to  
give a short wave to  
sounder when 1 is open & No 2 100 =  
after closing 1 is opened =  
Reverse effect it also when  
2 is closed.

This is about something as X  
on preceding page Except only  
1 Relay used

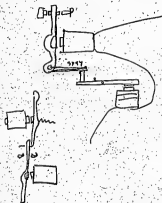
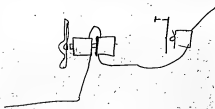
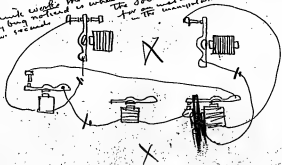
## Dextroplep

June 1 1877 -



This I think would be the best way to connect the two wires. I was advised not to put yet the only thing being said was that there is some different polarity coming from the currents.

Best bug  
trap yet  
seen



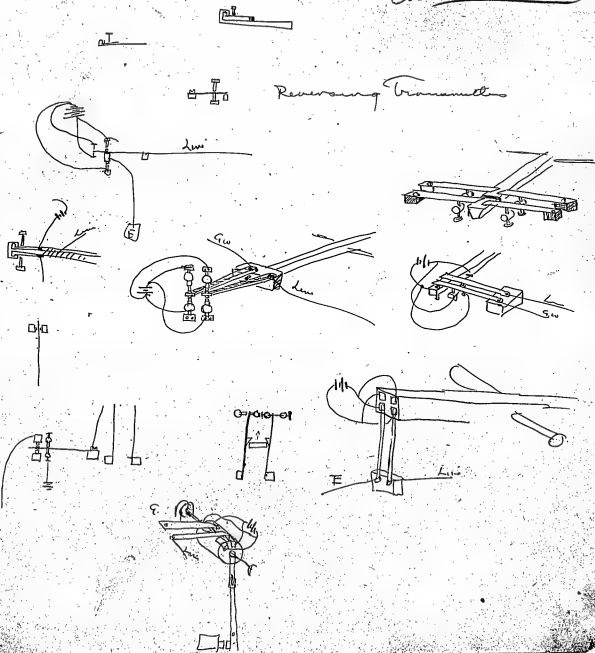
Then don't work as well as X  
cos n is too much for  
the complexity formula

DeMott -

June 1 1877

Edison

Char. Matchless





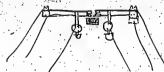
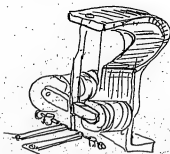
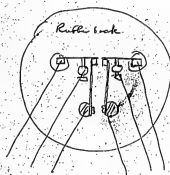
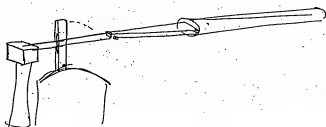
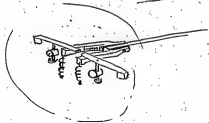
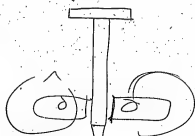
DeLuxe

May

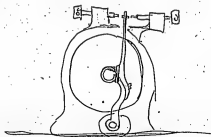
June 1. 1877

Person

Chas. Patchin



*Donkey*

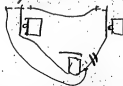


June 3 1877

J.A. Givon

*Charles Adams*

*James Adams*



*Amis Edwards Island*

*Thomas Givon*

*the Scottish Naturalist*

*the*

*The heart*

*The heart of heraldy*

*The heart of her*

*Fort of Ideas*

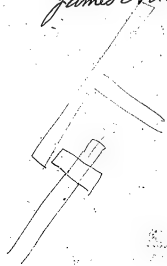
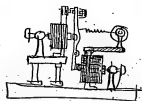
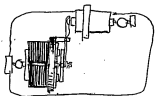
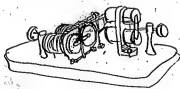
The boast of heraldry of pomp and power  
all that beauty all that wealth ere  
gave alike await the inevitable hour  
The path of glory leads but to the  
grave Grim visaged War has  
smoothed his wrinkled front but

june 14<sup>th</sup> 1877

done

Mathew Watson

James Adams



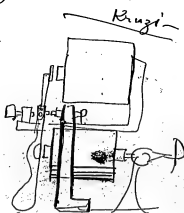
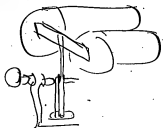
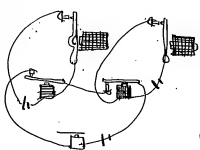
Sextuplex

May June 5 1877.

30 Edison

*Chapman*

James Adams

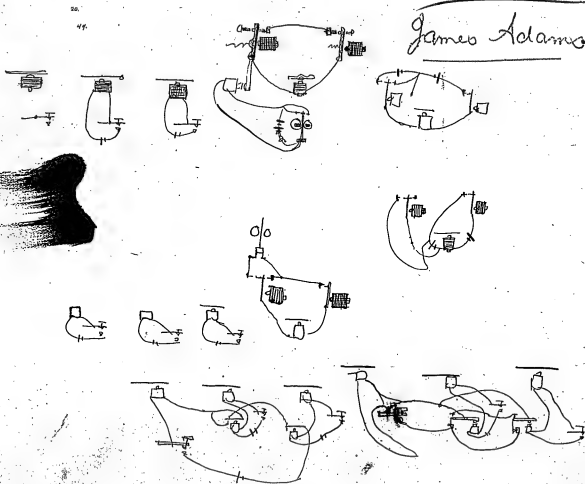


of Dey's

June 5 1877.

Max Patchelor

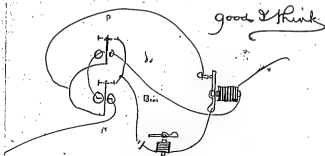
James Adams



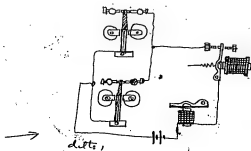
*Deitrop*

June 5 1877

During



The reversals give a kick  
due to break in continuity  
in the passage of the  
polarized tongues.

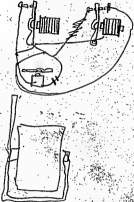
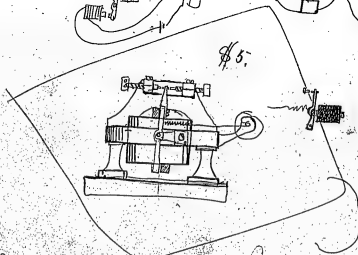
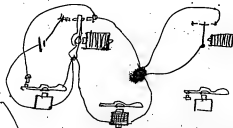
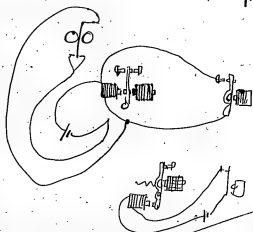
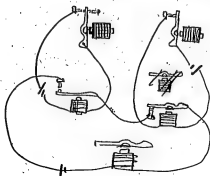
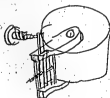


Disrupter

June 5 1897

~~Journal~~

Chas. Patchen  
James Adams



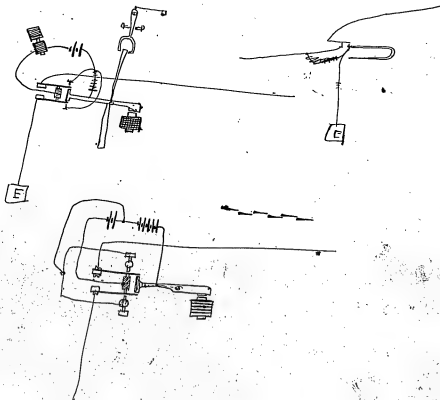
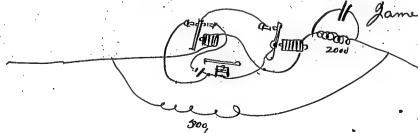
Delw. June 8th 1897

220

*Stratuplex*

June 5 1877  
Bath

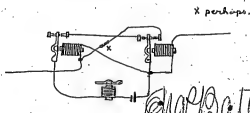
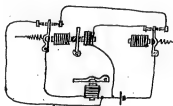
*Chas. Bate*  
James Adams



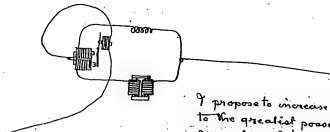
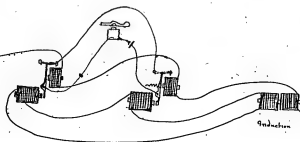


Dextuplex.

June 6 1877.



Wm. B. Dextuplex  
James Adams



I propose to increase the inductive current to the greatest possible extent and use this current which appears at the moment of reversal to act upon a separate Electro magnet, which tends to pull or attract the relay lever in the same direction as it is attracted by the magnet in the main line circuit, and by a proper proportionment of the two magnets acting on the same lever I hope to make the inductive current magnetism in one magnet equal in strength to the main current magnetism in the other magnet, thus bridging over the interval of no magnetism in the main line magnet by a magnetism of equal power in the inductive magnet.



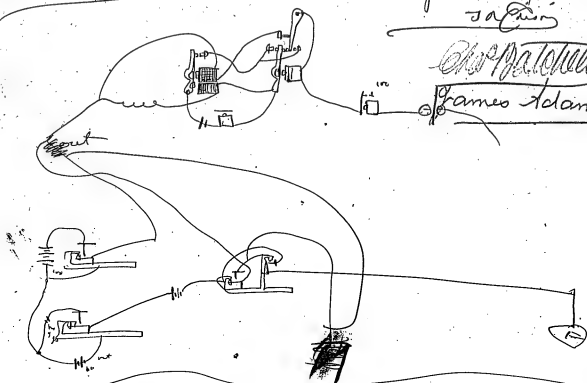
Septuplex

June 7 1877

Japan

Chas. Patchett

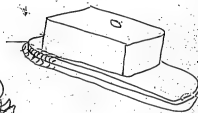
James Adams



Spoke & Elch

June 7 1877

Either Galvanic or Telegraph  
is the best substance so far to  
mix the plumbago with  
for the point in the holding  
Telegraph



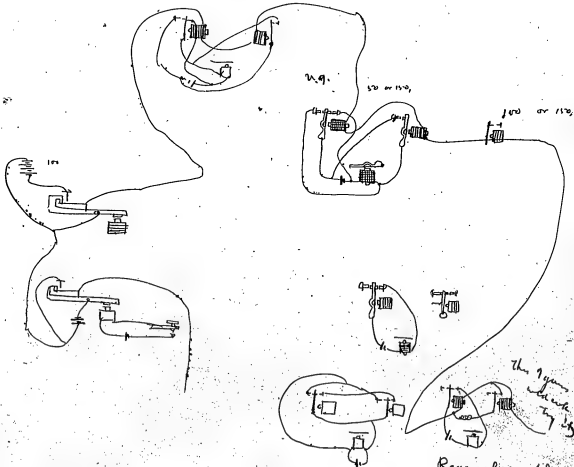
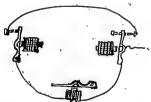
Sketches

June 7 1877

Japan

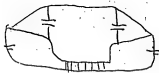
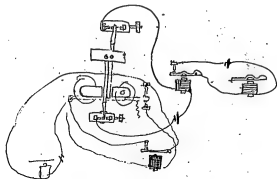
Chattanooga

James Adams



The figure above  
may be  
Reversed, might  
be made to  
work with it

Extempore

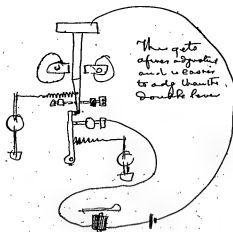


June 8 1877

Tolson

Chas. Batchelor

James Adams

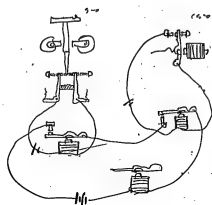


This gets  
after a good  
and is easier  
to add than the  
Double Bell

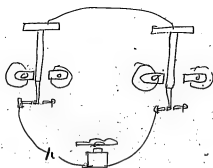
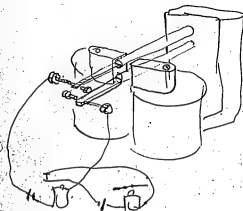
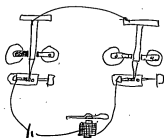
Scribbler

June 8 1877  
Edison 11

Chas. M. Mitchell  
James Adams



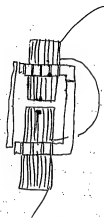
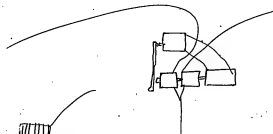
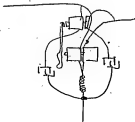
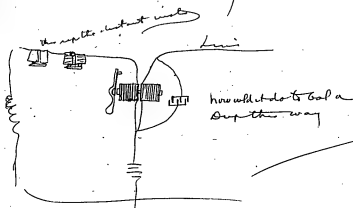
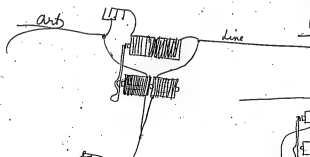
Thompson's Battery



SS Soxplex

June 10 1877.

*Chas. Batchels*  
*James Adams*



Magnet made of pence so  
as to discharge quickly &  
give scarcely any  
induction current. It is  
pencil separated by 1/16 in.  
or other material dry  
gold leaf or thin brass foil. 1/16 in.

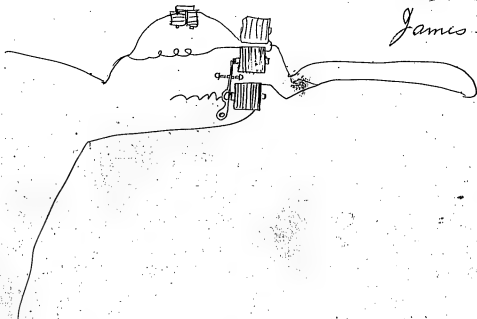
2 page

that will send the type wheel ahead & letter  
for a positive & 1 for a negative. <sup>opt. to opt.</sup> hence  
can by the use of an embosser work a  
transmitter in a local circuit & record  
from the paper & send the signal  
was recorded on a 2nd Embos. Trans &  
then take the to a translating or handset  
in the same machine and convert it to  
a print & print the message automatically

June 10, 1877  
Edison

Exclusory

Charles Adams  
James Adams



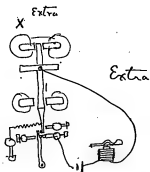
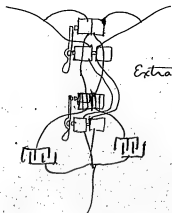
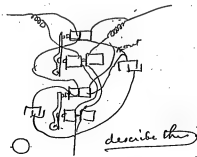
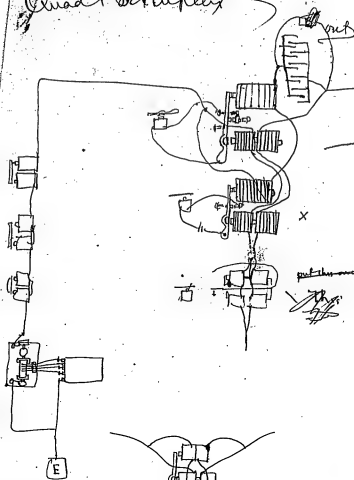


Quad & Duplex

June 10 1877

Salmon

James Adams



Qual & Scripter

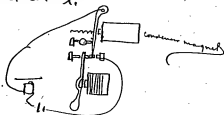
June 10 1897

Talbot

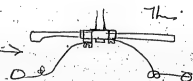
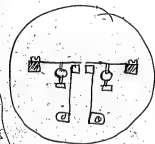
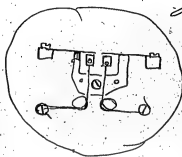
James Adams



put this in  
mitten that extra induction  
magnet may be put at X.



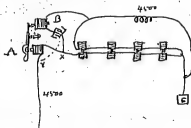
Mention Condensers of  
thick dry paper only  
~~condensers~~ insulation so as to give the it capacity  
show this in patent,



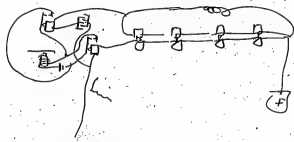
Wextuplex =

June 11 1877

J A Edison

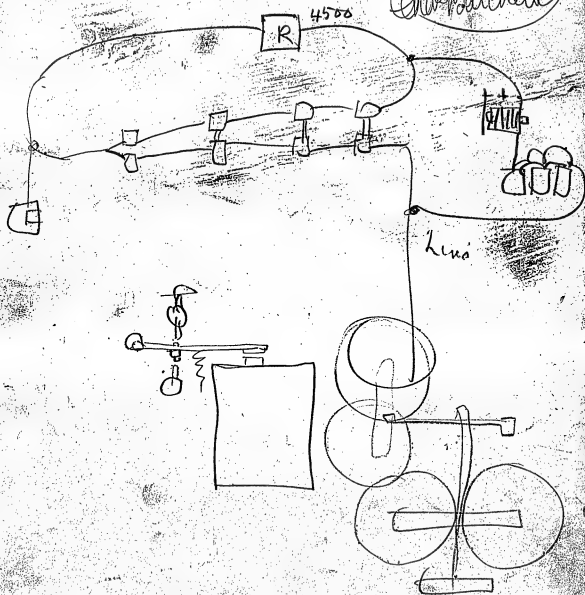


With the 4 mf condensers the effect on A is to cause writing to come heavier by reason of the slight magnetic return in B by the condenser current on opening & quickening it on closing. I find that with aid of Condenser at X, instead of X the writing is lighter, therefore the return cannot be attributed solely to the whip of magnetism in B. probably the discharge or effect of the Condenser on the magnet would be to make the whip and the would explain it together with the whip of magnetism, the amount of Condenser charge & discharge with when operating by rise & fall of tension is exceedingly weak in comparison with that due to reversal, perhaps  $\frac{1}{40}$  to  $\frac{1}{75}$  the part as strong, even with No 2 of 150 cells the current barely moves the armature. I find that with the 50 cells No 1 the effect of permanent magnetism in the relay has very bad effect and with the top Magnet arrangement I have the writing is rendered lighter when reversed as we sent but you can get writing good at 40 or 50, in the first point even when rapidly reversed. Tried this the other night & it appeared to work when I had Condenser getting it turned by a short around a 400 ohm short-circuit relay but with the above arranged the Relay C being in the line & D in the Condenser ckt the reversal showed.



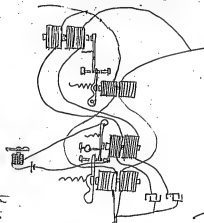
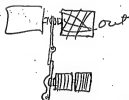
Decipher

June 11 1877  
J. A. Edison  
Chattanooga

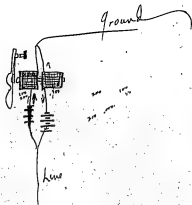
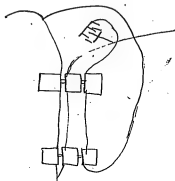
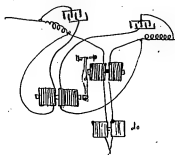


deuxplex

June 11 1877



Reversing through  
a relay without  
opening ~

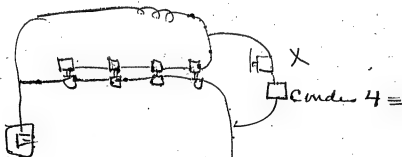


Experiment

June 11 1877

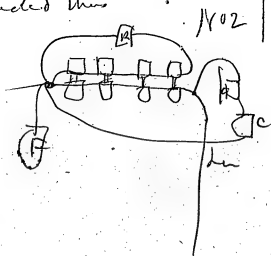
Experiment

No 1



with 7 mf. & do not get  
any better kick on X than  
with  $1\frac{3}{4}$  mf or 72 sheets  
connected thus

2mf

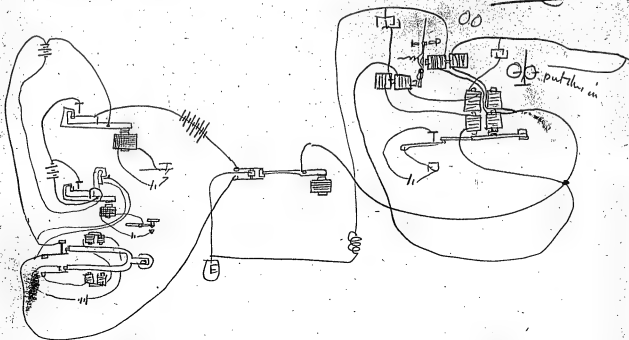


besides putting the  
Cond as in No 1

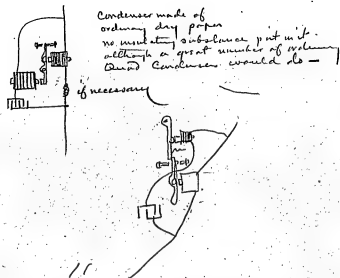
It makes a bigger  
no magnetism time  
than in No 2. I think  
the Cond on Bosc  
is not good.

# Acoustic Telexplex

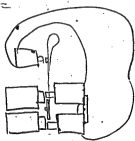
June 12 1977  
J.A. Johnson



This is the relay that I don't open on a reversal



Disturbance =



June 12 1877

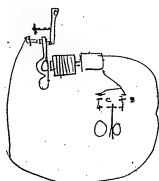
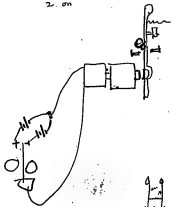
J. A. Edison

*[Signature]*

30, 60, 100.

100.

2. 75  
2. on



50, 100

$\frac{100}{200}$



work no 1 with 30 cells; no 2 with 60  
and open 1 when two is closed with 75 extra  
or 50<sup>no 1</sup> 100<sup>no 2</sup> open 1 with 2 closed by 100 extra

50, closed, 1  
75 " 2  
P

125.



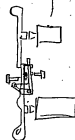
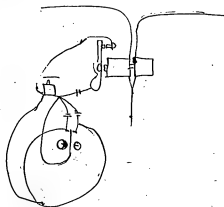
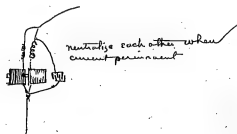
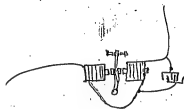


Sextuplex

June 13 1877

J A Edison

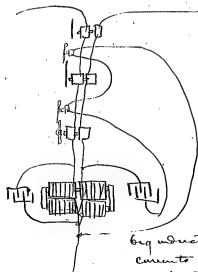
*Charles Adams*  
James Adams



Distriplex

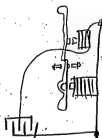
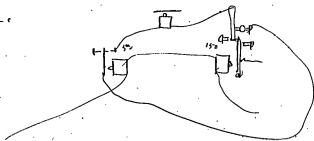
June 13 1877

Chas. A. Adams  
James Adams



big induction magnet diverts  
currents into Condenser by its  
self induction and magnetic  
induction in changing polarities

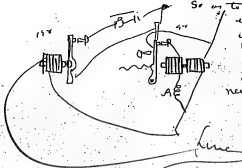
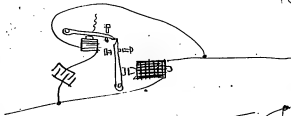
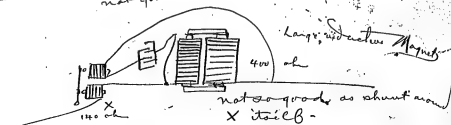
note



Seetplex

June 13 1877

Edison  
Chas. S. Adams  
James Adams



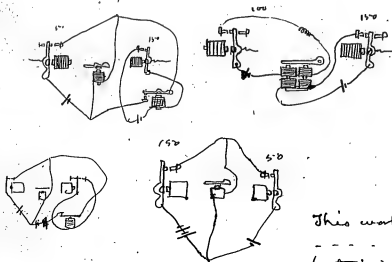
I find that it is better to  
shunt the Condenser & to magnet  
around its own magnet  
rather than pass on or around  
an outside separate resistor  
or long magnet &  
It works perfectly as long  
as the regular magnet is adjusted  
So as to give only a moderate back  
or reluctance force  
if magnet travels right up to  
heavy apex but as the resistance  
being to be overcome the Condenser  
etc. is not enough growth  
for it to be a true magnet only  
neutralize 100, 50

line  
Edison

# Synoplex

June 14 1877

T. A. Edison.



give 150 man the  
advantage in strength  
in border magnet  
so a little excess of  
his current will neutralize  
Self magnetism of S. So  
although this may not  
be essential,

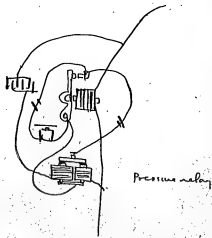
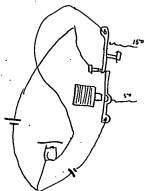
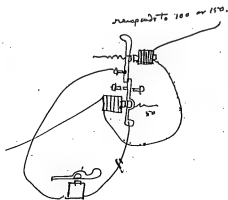
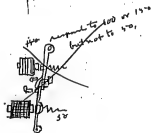
This works well still tho.  
- - - - - being is in this.  
but this time its an opening  
before two on closing

The trouble is caused by the 50 relay having a light adjustment, the addition of the 150 causes a permanent set in the Core so that when all current is taken off ~~that~~ the lever of 50 don't fly away as soon as that of the 150, if 150's mag is adjusted so it reaches 100% of char. amp. Core is as that of 50 then its Core is further away & act. g. with  $\approx 9$  sec. this effect by the local spark on 50's point. Theoretically both levers ought to leave at once but this & no spark appear but as a spark does appear retard on 50's point & infer that this lever is sluggish it should be shortened.

Diagrams

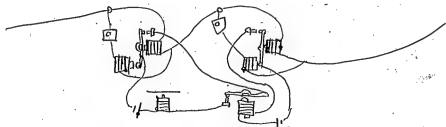
June 24 1877

I am testing for bugs with Chemical reading machine



8-21-1914

June 14, 1877

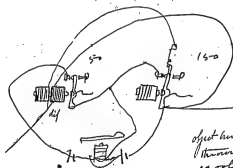


Textuplex

June 17 1877

Edgar

Chas Batchelor



just being to get and after the set by  
thinning in an open opportunity around  
spoke to venturing the 100 50 in  
but still have 50 00 hours when all  
for the 50 relay will open  
from this 50 in only 50  
call magnification in its area

Chas Batchelor

Chas Batchelor

Batchelor

Chas Batchelor

Chas Batchelor

Chas Batchelor

Chas

Batchelor

Batchelor

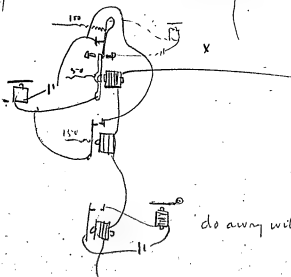
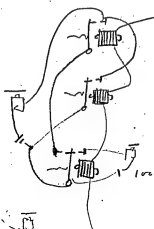
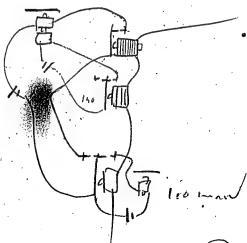


# Antiphrasis + Onomatopoeia

June 21 1877

Tafelberg

Chapin



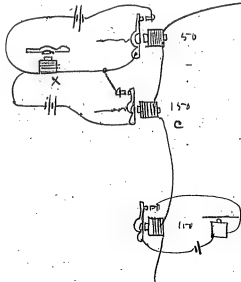
do away with the 4 use X

Decoupler & Ques

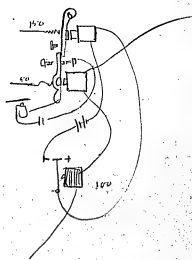
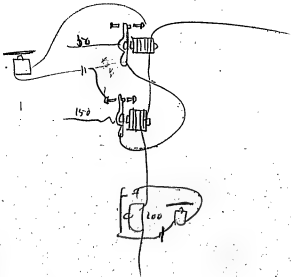
June 21 1877

J. J. Carson

Nov 30 1877



50 on perm X open  
to close X take off all  
battery or when 100 near  
on 4 C attracted put  
50 cells to close this  
done at the transmitt  
End =

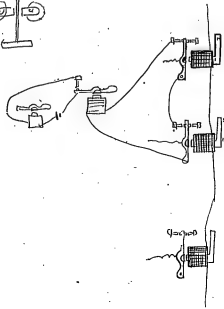


Destiny's Angel Etc

June 21 1877

SA Com

*Wm. S. Adams*  
James Adams



V 12

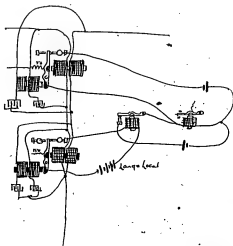
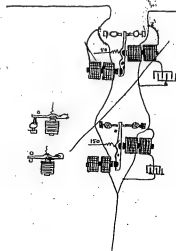
Boston Boston



Sixty

June 22 1877

Har Bachelor  
James Adams



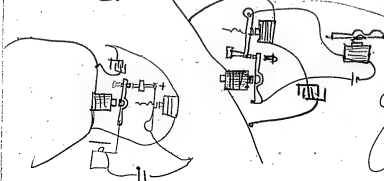
Double

June 25 1877

W. Adams

W. Adams

Comb these two for me + dec 30 or 31



Good I think

Good I think

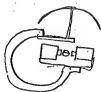
Spokane Telegraph

Success you see!!

Quadruplex & Sextuplex

July 5 1877.

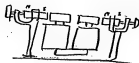
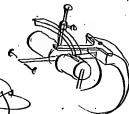
James Adams



@



Permanent Magnet  
Correction on Quad  
Balanced Polars

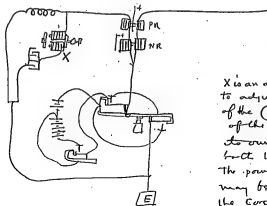


Anal & Description

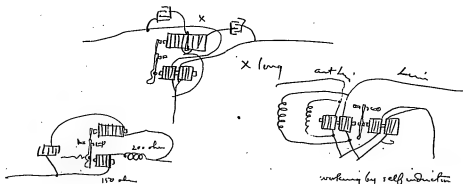
July 7 1877

T. A. Edison

Chas. Batchelor



X is an adjustable magnet to adjust the charge & discharge of the Condenser to meet that of the line which it does by its own self induction delaying but the charge & the discharge the power of the self induction may be regulated by adjusting the Core to or from the set armature



a relay upon Core reverse through without opening =

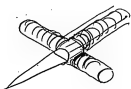
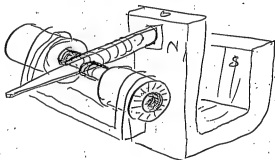


To get rid of the permanent magnetism or set in a magnet expand a relay & relay under Anal A per space to use from Core of layers of wire or wire =

Amesbury

July 7, 1877  
Ta. Edison

Chas. Ratcheln



hollow spools to suck in light extensions of  
the polarized torque, passage of the  
current cannot leave any permanent  
magnetism in the wire tubes as there  
is no use to magnetism and if the  
torque's magnetism is increased or  
diminished it will make no  
difference as there is nothing to  
attract it or it to be attracted.

Plumbago 1 inch wide  $\frac{3}{4}$  in thick

weight 16 grams R on No. 1 foot, over

10,000 ohms

700 "

" 60 "

3,000 "

$\frac{1}{2}$  lb

60 "

1 lb

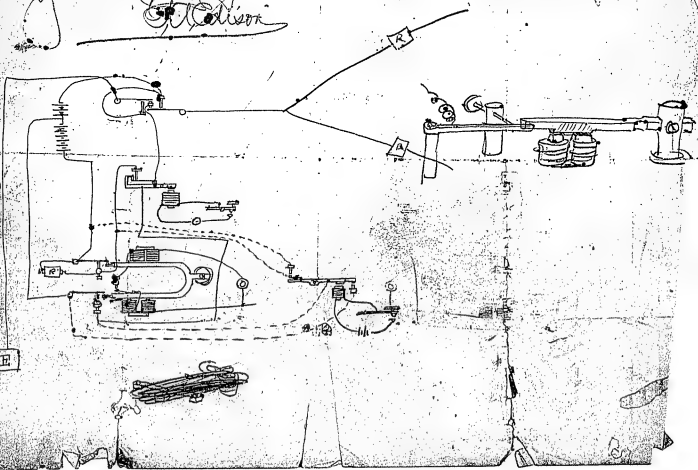


Texturplex

March 23rd 1899  
Station

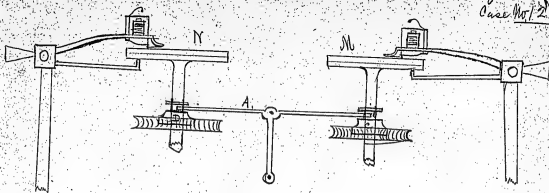
How

How



[March 1877]

Fig. 3.  
Case No. 128



[March 1877]

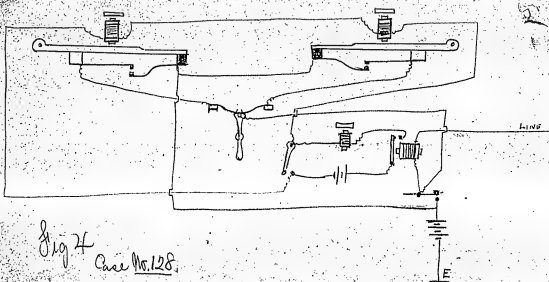
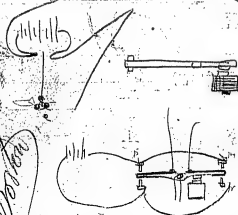


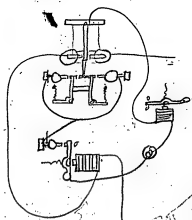
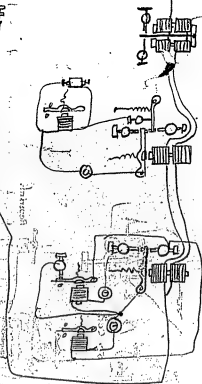
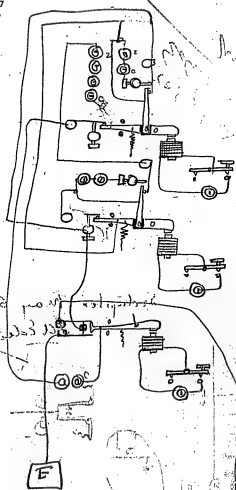
Fig 4  
Case No. 128.

(E-1694)



#218  
436 2616  
218 354  
Work 23 10/23/2  
432  
354  
Thos. A. Edison 432  
24 24  
18 16  
142 144  
24 24  
432  
anti. Continuity 384  
Perron  
for Q. and Duplex  
Transmission

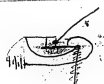
April 30 1877  
T. A. Edison



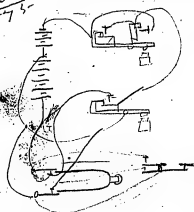
25-

$$\begin{array}{r}
 223 \\
 25 \overline{) 5575} \\
 \underline{1115} \phantom{0} \\
 446 \phantom{0} \\
 \underline{5575} \phantom{0} \\
 0
 \end{array}$$

Portland, Oregon

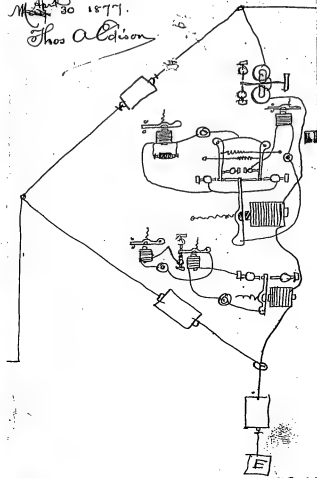


1	2	3
6	5	4

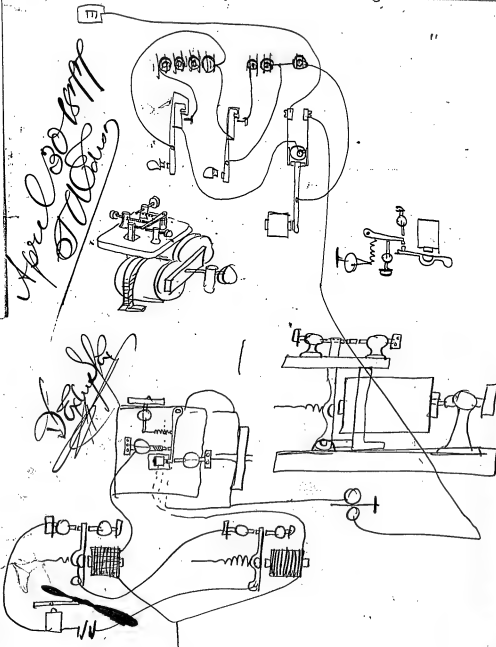


$$\begin{array}{r}
 * 2 \quad 466. \\
 30.
 \end{array}$$

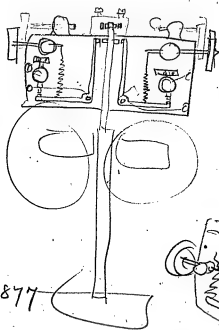
Sextuplex  
 wing for model  
 March 30 1877.  
 Thos Edison



April 30 1877  
 Thos Edison



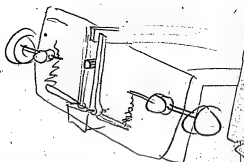
~~\$10,~~



May 3<sup>rd</sup> 1877

Duplex

J A Edison

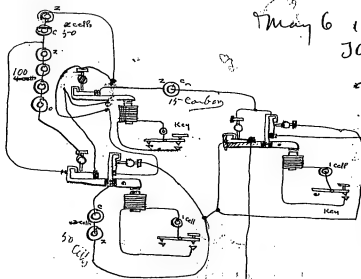


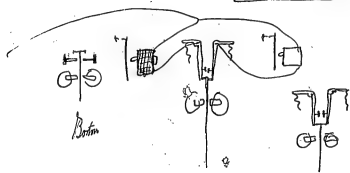
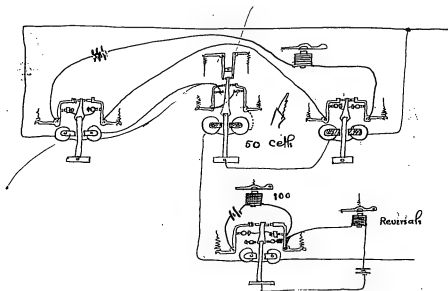
Apr 24 Delvd. May 1<sup>st</sup> 1877

Seduyobek

May 6 1877

JA Edison





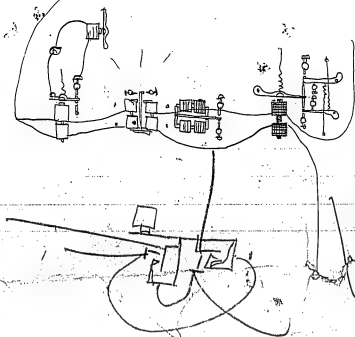
Stedman May 6 1877  
J. A. C. C.

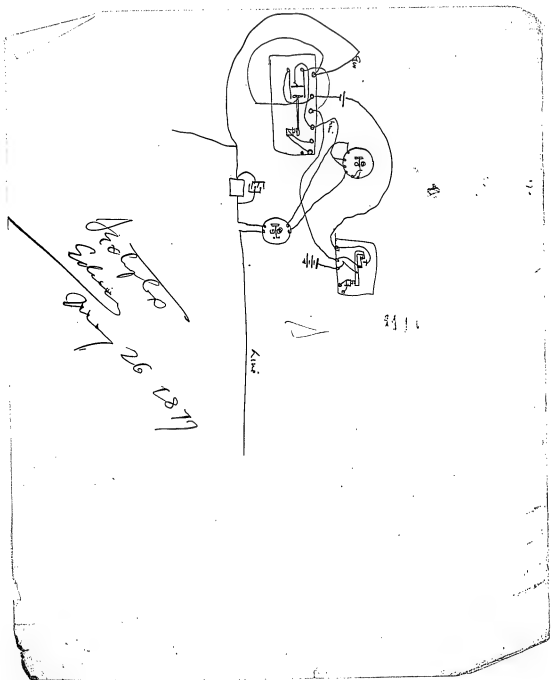


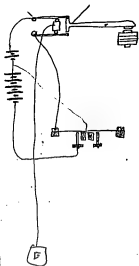
Sturges

May 7 1877

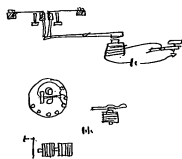
J. A. Evans

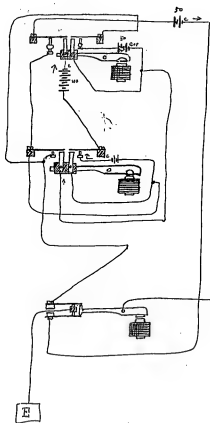






Just before  
 Edison  
 Aug 26. 1877

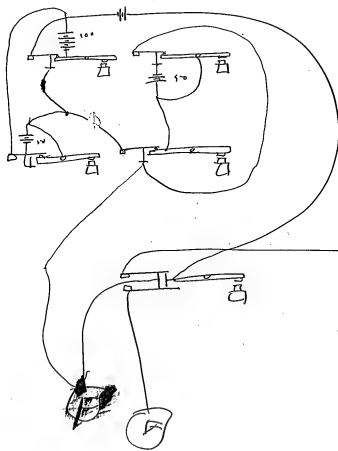




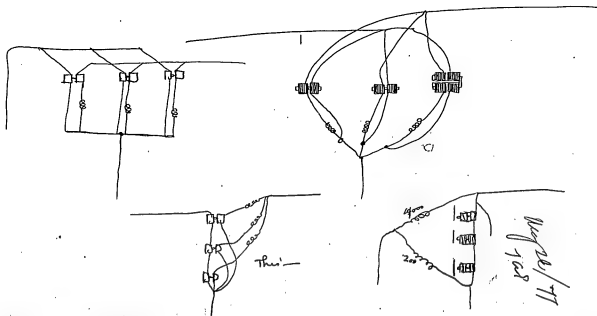
Letter

May 26 1877

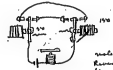
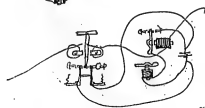
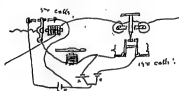
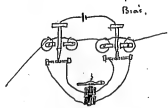
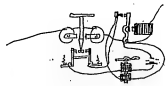
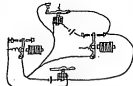
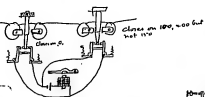
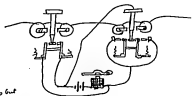
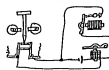
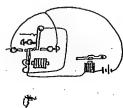
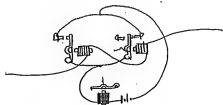
Edison



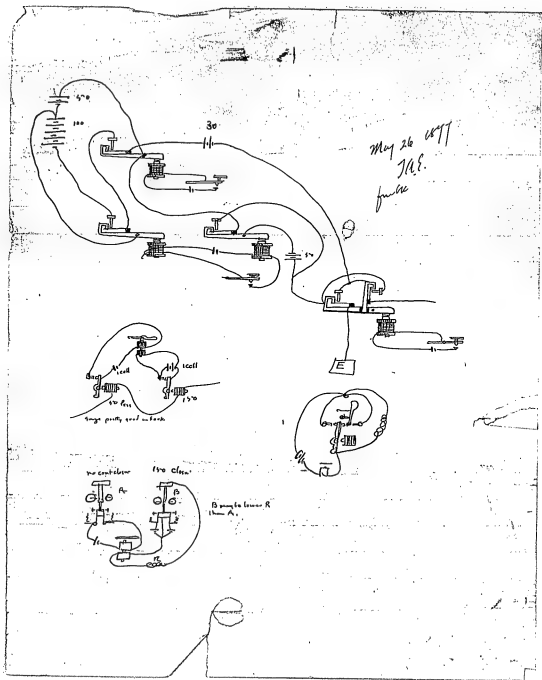
May 26 1877  
Edison  
Sealed



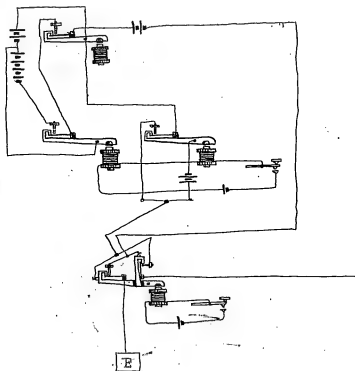
May 26 1971  
2nd  
Lena



made in both ways  
Remember Don't forget  
don't forget

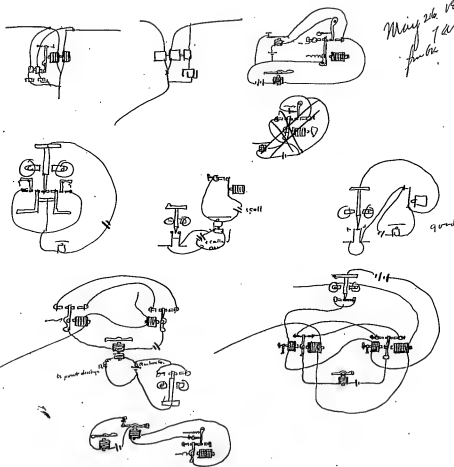


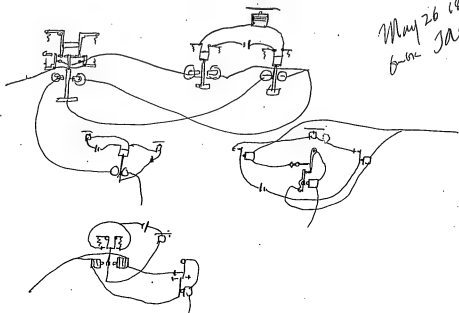




Wm. de v. 1871  
 17/10/71  
 17/10/71

17



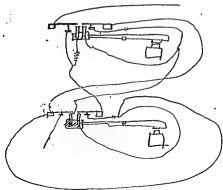


May 26 1947  
to the JAS

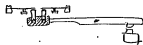
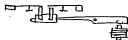
Way Station Duplex

May 31 1897

Tolson  
Chas. Batchelor



Bull



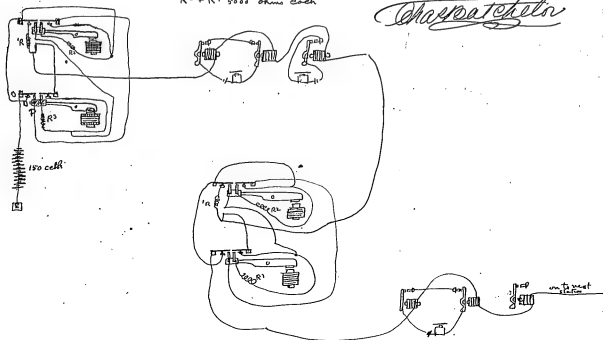
Way Station Duplex

May 31 1877

W. A. Johnson

*Chas. A. Johnson*

$R^1$  10,000 ohms  
 $R^2 + R^3$  5000 ohms each

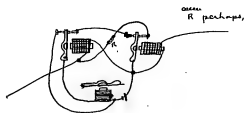
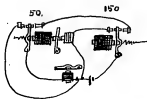


6400	1600
3200	800
1600	400
800	200
400	100
200	50
12600	

WU Bldg June 6 1877  
7th Edition

*Leontopodium*

Nº1



With No 3 trans open and No 2  
open I get the 50 cells of  
main bat with No 2 closed  
3 open I get whole battery  
but with No 3 closed &  
No 2 open I get nothing  
I just done that now want  
trace it.

C

No 3 closed & No 2  
open

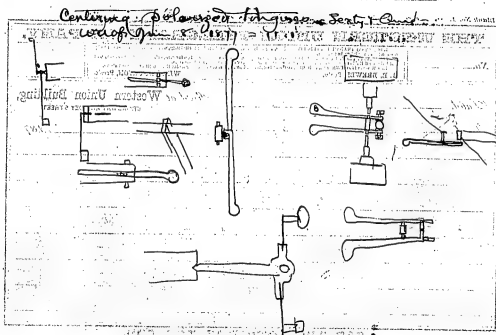
No 3 wire from the switch goes to the  
first thumb screw in No 3  
polar & you also wire for  
Switch No 6 goes to  
1st point in No 3 common  
only then to the polar &  
back via wires No. 4.  
and .5.

3 closed & 2 open  
 No 2 = Both closed  
 seem get whole Gall  
 (but with 2 close)  
 + 3 open get  
 bigger battery

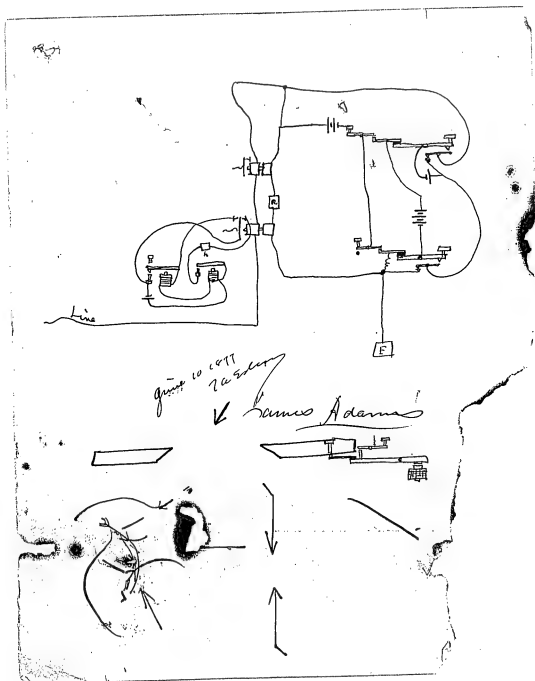
its either on the inside  
 of No 2 transmitter  
 or on the ~~inside~~ of  
 No 3. Gauss

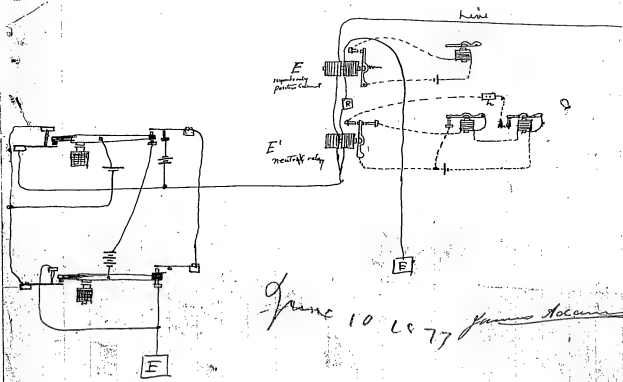
Either the wires in the  
 front of 3 are reversed  
 in their binding posts  
 or reversed in the inside  
 of No 2. or the battery  
 on No 2 is reversed.

Suppose you reverse  
 your battery on No  
 2

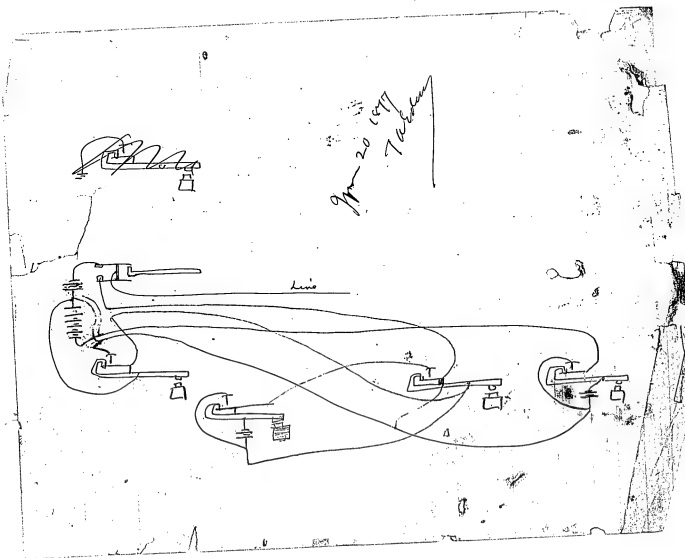








June 10 1977 James Holman



Shunt  
Shunt  
Shunt  
Shunt

$$\begin{array}{r} 5872 \\ 1104 \\ \hline 4768 \end{array}$$

$$\begin{array}{r} 5872 \\ 4000 \\ \hline 1872 \end{array}$$

$$\begin{array}{r} 5872 \\ 3500 \\ \hline 2372 \end{array}$$

3500

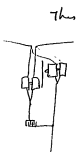
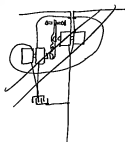
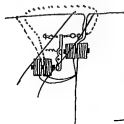
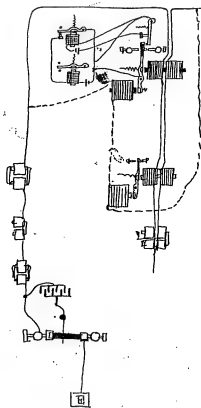
$$\begin{array}{r} 160 \\ 1120 \\ \hline 1280 \\ 7.75 \end{array}$$

$$\begin{array}{r} 302 \\ 18 \\ \hline 2446 \end{array}$$

$$\begin{array}{r} 12340 \\ 1184 \\ \hline 1361 \end{array}$$

$$\begin{array}{r} 302 \\ 18 \\ \hline 2446 \end{array}$$

Brooklyn



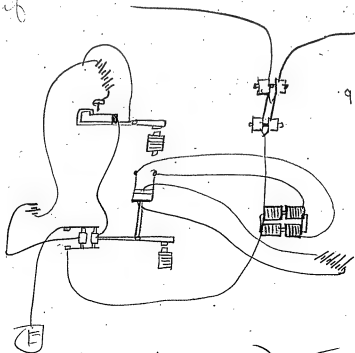
June 22 1977  
Tad  
scot

This

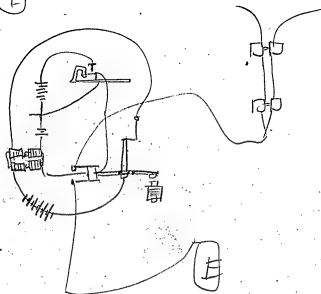
Quad

diff

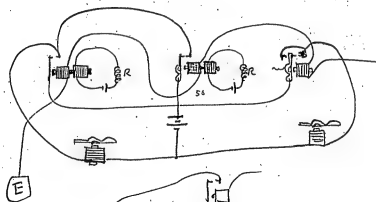
June 21 1877  
Estlin



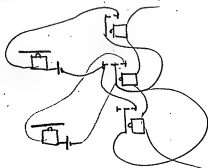
9 think reversing the  
current through the  
mag will increase  
the comp better than  
old way of straight  
current



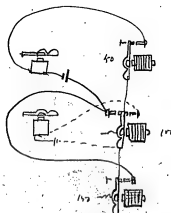
June 21, 1877  
J. M. Schenck



stark



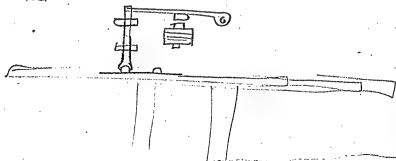
Duplex



Wont work

June 21. 1877

How would it do to Employ paper covered  
with plaster paris for the translating  
Embosser if you want to raise in place  
of indent you could raise a boss spiral  
or then have the



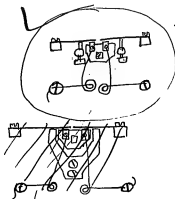
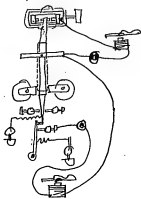
June 22 1877

Print points on the Double relays

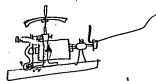
$\gamma_5^c$



Not in the model have Serrell draw them  
 Say that a resistor can be inserted at a - a .

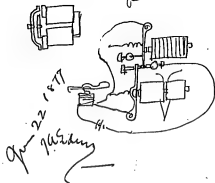


Draw a condenser made of  
 aluminum insulated with  
 dry paper or dry paper  
 previously soaked in chemical  
 solution which gives great  
 polarization

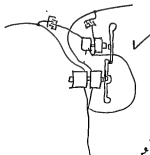
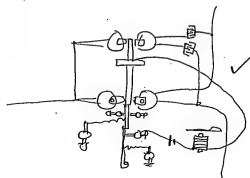


for balancing  
 permanent magnetism

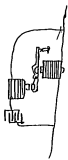
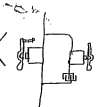
Mention that when it  
 of putting 1000 to 1500 ohms  
 resistance in Condenser magnet



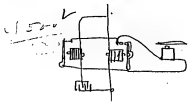
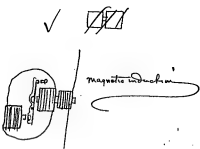
for 22 1/2 1/2  
 phasing

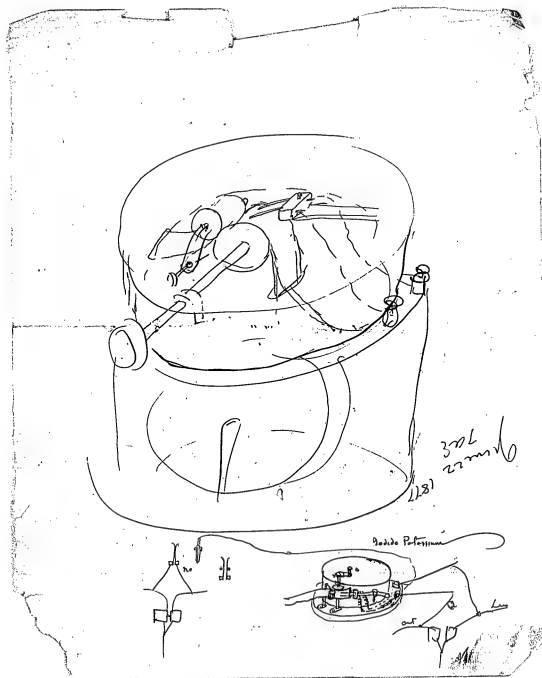


June 22 1977  
T.A. Edm.  
Randy Roney



4 - bridge arms



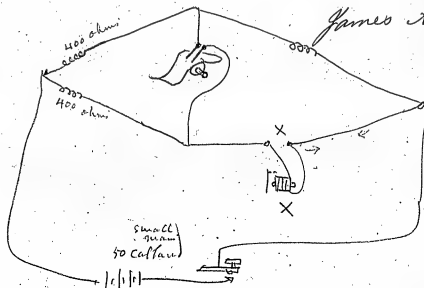


# Induction of Magnets

June 25<sup>th</sup> 1877 -  
Found paper -

Chas Batchelor

James Adams



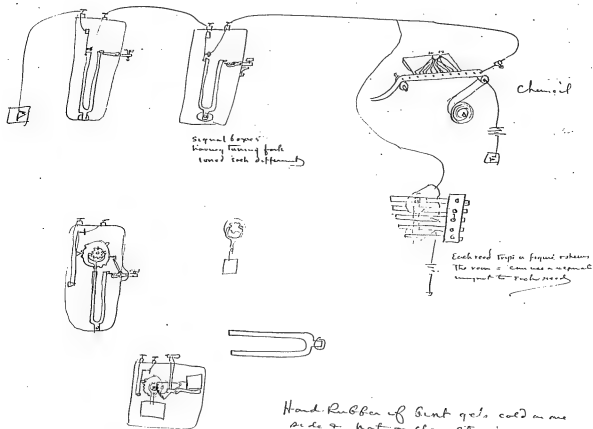
We made a Wheatstone bridge after this manner 400 ohms on each side of one end of bridge and at X the magnet to be tested with its correspondent resistance in other side. we used 50 cells Calland & put Automatic Instrument with double Pen in bridge wire - With a 100 ohm W.V. Relay at X and the cores touching the armature we got this:-

# Hotel Annunciation & District Telegraph

June 27 1877

J.A. Adams

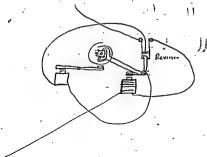
James Adams



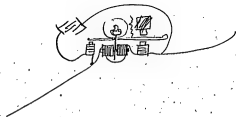
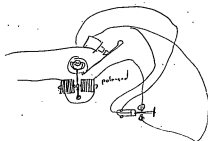
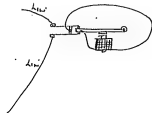
Free Stroke Printing Reel

June 24 1877.  
Saginaw

James Adams



side view  
self vibration

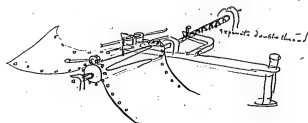


Translating Anderson

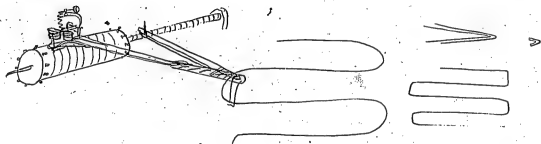
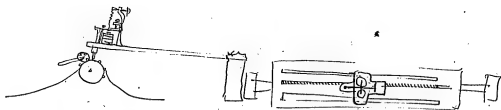
June 27, 1877

J. A. Adams

Charles Ketchel  
James Adams



on the continuous roll below & propose for obtaining accurate regulation  
to previously prepared holes either on both edges or on both edges & the  
center or on the center only and provide the rotating cylinder  
with pins to pass through the perforations & ensure the feed  
& regulation



Pr. 6

Telegraph Reporter

Reading &  
Pinehurst

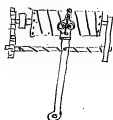
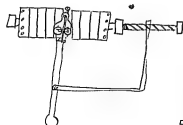
Monday  
12



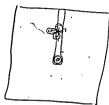
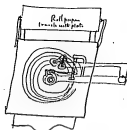
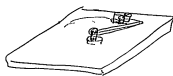
Translating Ambassadors

June 27 1877  
S.A. Dixon

Charlottesville  
James Adams



It may be possible that oiled  
inducting paper is preferable,  
or that the paper should  
be paraffined - shellacked, or  
dipped in plastic paraffin water =

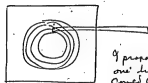


# Translating Embosser

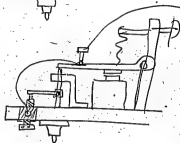
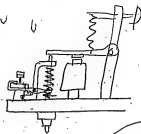
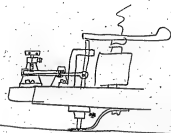
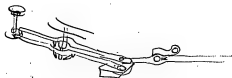
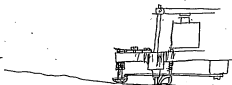
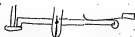
June 27 1877

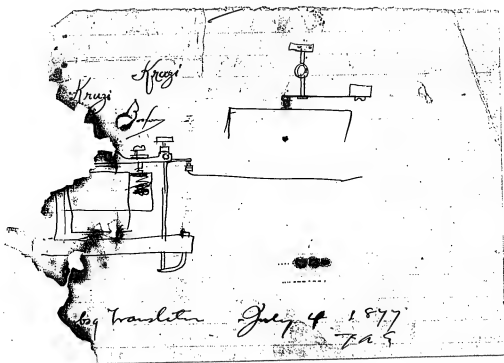
J A Edison

James Adams



I propose in next translation to have the repeating points  
one line inside the embossing points, although it  
could be one line outside





Autograph Machine  
Trade Mark

July 5 1877

James Adams

For Autographic I write your message by embossing on  
parafixed paper

Contact



strained by a spring

2. Write with an Etching pen & then adopt the  
vibrations auto plan of geograph sending  
by vibrating the contact point ~~against~~ against  
the paper by a turning fork making several  
individual vibrations per second when no  
ink occurs the needle cannot pass through  
the paper hence no contact & when it does  
occur it passes through & thus allows it  
spring to come in contact with it plasma  
point closing the circuit.

3rd Write with a sticking ink broad  
no pen dust over with plumage &  
pass under a press or optimum roller  
the will make it cardinally working  
use 2 feet to close circuit



passing the mark the  
plumage from a ~~curve~~  
between the pens

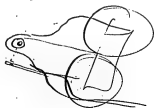
# Embassy Translator

July 5, 1877

70 Essex

I propose to make the groove James Adams  
to put revealing point one or 2 lines behind indent  
+ other revealing points when necessary by extra lines or points  
in trail

To my Embassy paper



Machine oil. I prefer any oleaginous substance  
will answer even the gums will work by stiffening  
the paper & all semi hard materials which  
the paper can be impregnated with well  
work = Instead of Embassy in paper

I can use thin Copper or other metallic  
foil, and I can arrange the circuit  
connection in such a manner

that the foil will close circuit & the  
induction will open by its point falling  
into it & not prevented from going to the  
bottom by a limiting pin

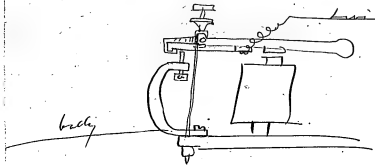
# Embossing Translator

July 5 1877

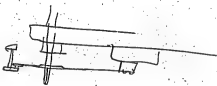
J. A. Edison

The embossing point itself may be made to repeat the retractile spring being depressed with the lever by its own weight cause the embossing point to lay on the paper. When an indentation occurs it falls down & the lever striking a spring contact point closes the circuit.

James Adams



to obtain accurate repeating when it is undesirable to use the embossing point, a hole may be drilled in its center & a needle pushed down through it the needle caused to the spring & a contact close

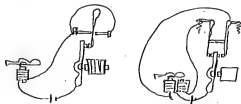


Translating Emboss

September 8 1877  
J. A. Edison

James Holmes  
We find that sand oil is the best thing for soaking  
the paper to be indented - We have tried some preliminary  
experiments with the Continental roll embosser  
and it looks as if it would be successful

Desulplex



September 8, 1877.  
3rd Edition

James Adams

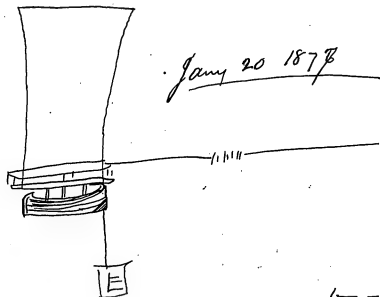
11/10/91  
H. J. Adams

2  
\$10

the ga



## Speaking telegraph



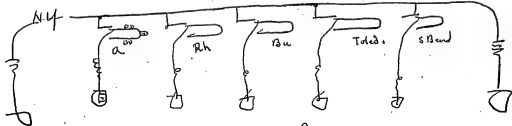
Jan 20 1878

These Platina points dont seem to work any better than one point yet it very good for a western Union relay though my little. but I think that I could get it better if I had an adjustment to it for Charley cant hold it steady enough

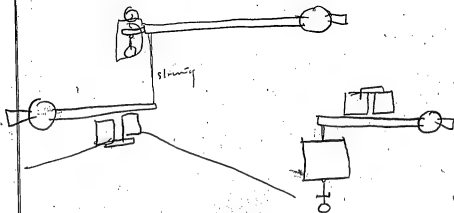
April 10 1887

7 Wdnesday

James & damp  
eh



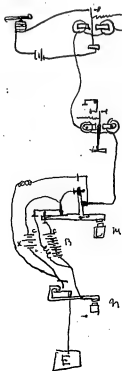
discharge line by  
turning forks worked by  
a to cut



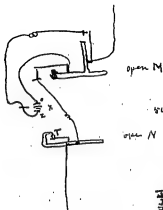
G. Smith and

April 11 1897

Tag

Chas. B. Leland  
James A. LamyBoth open  
Both closed50 cells 2 to line  
50 cells 2 to line.M closed  
M closed  
N closed100 carbons to line  
nothing

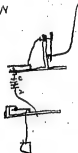
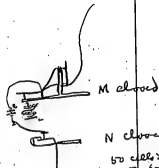
M closed	B on
M open	B off
N closed	X on
N open	X off
M closed	N open X closed

open X on  
closed X offopen X on  
closed B on  
no closed X on

open M

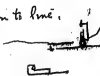
50 cells X - zinc to line.

open N

M closed  
100 cells carbon to line.  
N open

M closed

N closed

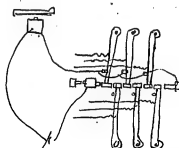
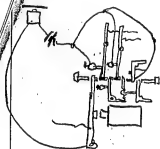
50 cells X  
zinc to line

April 12 1937

Gardner

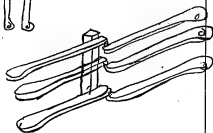
Increase +  
die bind +  
370 sextuplex

Chaspatcher  
James H. H. H.

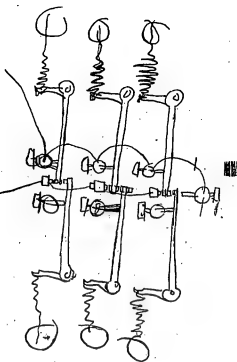


50 100 200

11



100  
200



50  
100  
150  
200  
250  
300  
350  
400  
450  
500



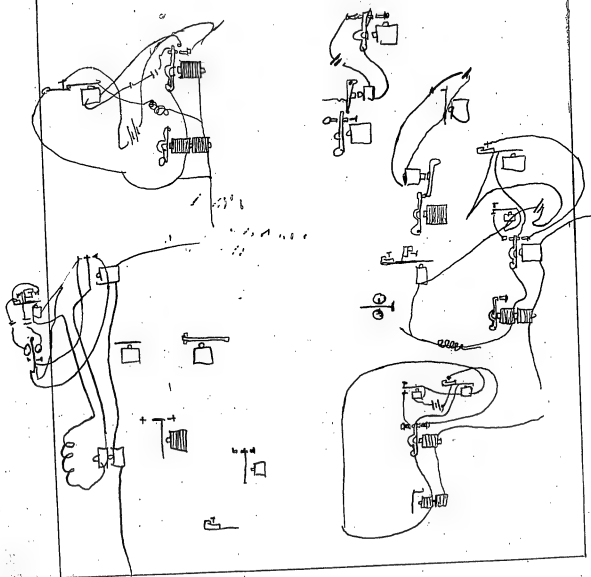
~~Ex Libris~~

April 12 1878

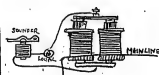
J.A. Edison

I think would be in a small platinum diaphragm would  
be best thing for Em Graph - with acoustic

James Adams



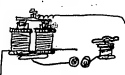
TRACINGS



Wasson Riley  
 May 10 1897

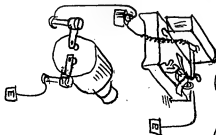
2a Edm

W. W. Matchless  
 James Adams





May 20 1897



Edwin  
Chas. B. Phelps  
James Keams



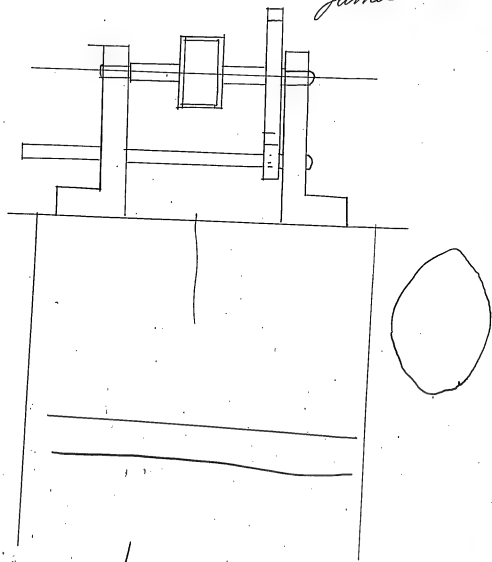
May 20 1897

Singing Telegraph

May 28 1899

Edison

Chas. Batchelor  
James Adams

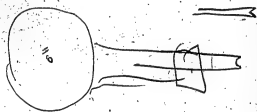
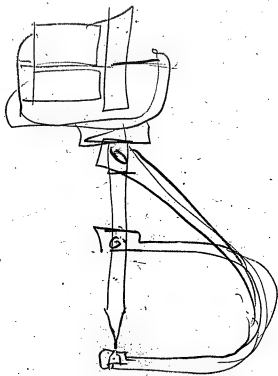




1878. General (NS-78-001)

Pen

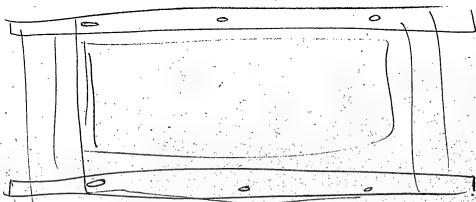
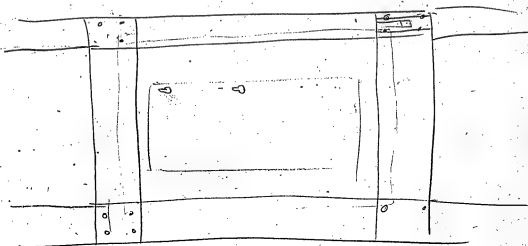
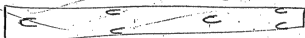
Feb 6 1878  
Golden



Rotary press

Feb 28<sup>th</sup> 1876

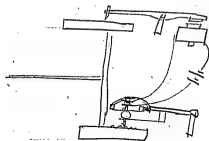
Chas. H. Hatch



April, 10 1878 -

Electric Engraving machine

J. A. Johnson



June 6<sup>th</sup> 1848

Chas. Datchler

When I cut a piece of Camphor long and  
rub a piece of sulphur <sup>or sealing wax</sup> and present it ~~at~~ with  
it long axis across and at right angles  
to the long axis of the piece of Camphor  
the piece of Camphor will immediately change  
its position taking a position parallel a piece  
of sulphur

When small pieces of Camphor are  
placed on table and a rubbed piece  
of sulphur <sup>or sealing wax</sup> presented they will jump  
 $\frac{1}{2}$  inch up to get at the sulphur

Sulphur rubbed has a much stronger  
influence over floating Camphor than  
Shilac or rubber

Sulphur rubbed and held close to  
water surface attracts at  $\frac{3}{8}$  of an inch  
the water which instantly leaves it  
again without wetting it  
It attracts equally well in the middle and  
both ends

June 6<sup>th</sup> 1878  
Camphor in small lumps ~~Quartz~~ <sup>floating in</sup>  
water: when you present a piece of  
Sulphur that has been violently  
rubbed on my coat ~~formed to~~  
~~polarize the camphor and~~  
attracted same ~~violently~~ <sup>when I presented</sup>  
~~the sulphur to the other end of the~~  
~~piece of camphor it would not attract~~  
~~till the pole turned round then it~~  
~~would follow the sulphur~~

~~Lycopodium in water is slowly attracted~~  
~~by Rubbed (+)~~

Also polarizes being attracted to  
one end of piece of Sulphur when  
the other end of Sulphur presented  
it repelled & went to the other pole

July 6<sup>th</sup>. 1848

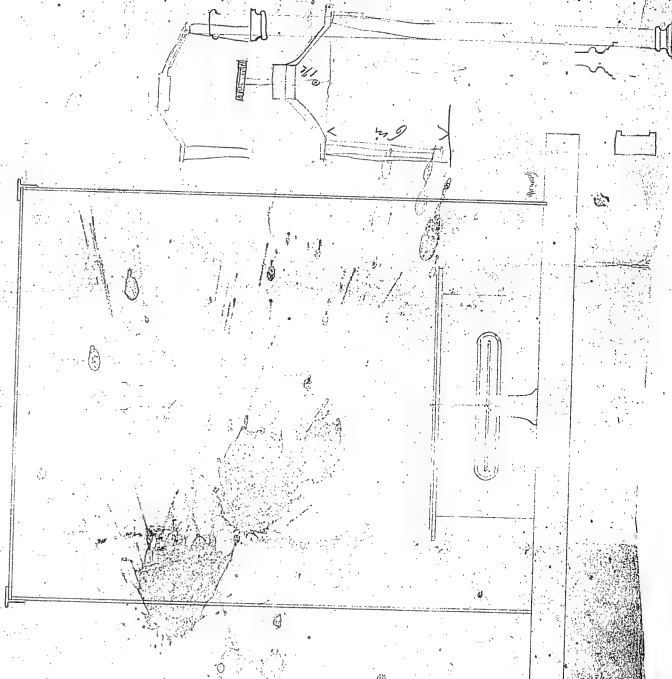
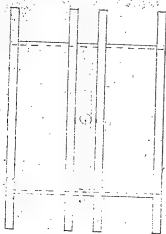
Sharp Patches  
Camphor and Sulphide of Antimony  
are ~~voluntarily~~ attracted by rubbed  
Hard Rubber, Shellac and Sulphur

Paraffin is attracted by Sulphur  
& rubber etc when rubbed

Positive and Negative electricity both  
attract Camphor.

In the needle experiment on  
the water Positive and Negative electricity  
both attract the corks but repel the  
needles.

государство:  
Москва, 26 Ок. 1917  
План 26  
Г. С. С. С.





Sixty

T. A. EDISON,

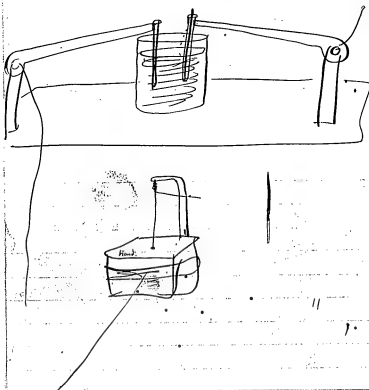
Menlo Park, N. J., 187

Palanome



June 21 1878

T. Edison



Carbon Rheostat

Scientific American

Tachometer - Scientific American

New one my expense

Microphone, my expense

Direct Current Telephone - my expense

New Patented & C. L. S. P. - my expense

New Phonograph

my expense

Current Governor

my expense

Microphone

my expense

Microphone

my expense

Musical Telephone

my expense

Harmonic Engine

Scientific American

Sp. Telephone for audience



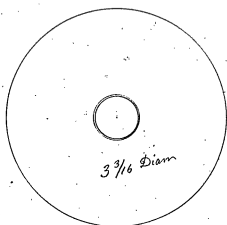
Long Sp. Telephone

Scientific Book



June 15/66

M. J. Geosonometes July 5th 1888



H. Field



T. A. EDISON.

Menlo Park, N. J.

July 31<sup>st</sup> 1875

Mr. Muesi

Have Andrew make

① six boxes for battery for

② two cells of Watson each.

You will find some of the  
blueprints for them in one  
of the drawers under the  
showcase

Batchelor

O.K. except 6 Binding posts

July 31<sup>st</sup>.

T. A. EDISON,

Menlo Park, N. J.

July 27<sup>th</sup> 1875

4

John Muesi,

Make ① one box for  
Stuff. to hold ③00 three hundred  
& fifty

Chas. Batchelor

O.K. consisting of seven (7)  
small boxes with sliding covers  
and one (1) outside box to  
receive them all, cover to  
sew on

J. Muesi

T. A. EDISON,

1875-67-27

Menlo Park, N. J.,

July 27 1875

5

John Kuesi.

Make a Carbon  
pressing die and a press  
to send to Paris to Adams  
also double cases for same  
for shipping.

Chas Batchelor

O.K.

Complete, and shipped  
to Baldwin's amoy & european express.

Aug 8th 1875

J. Kuesi

T. A. EDISON,

Menlo Park, N. J.,

July 27 1875

6

John Kuesi

Make one Carbon-silk  
resistance box like first  
made, but with scale on side

Chas Batchelor

Completed Aug 8th 1875

J. Kuesi

T. A. EDISON,

Menlo Park, N. J.,

8

July 20 1878

John Kuesi

Make ① one trough for  
electroplating about  
24 x 12 x 12. Ratchet  
bolted together.

Edw. Batchelor

Finished July 31.

John Kuesi

T. A. EDISON,

Menlo Park, N. J.,

July 30 1878

9

John Kuesi

Make a number of straight  
steel bars for magnets of same  
size to determine the best  
for magnetism

Edw. Batchelor

E L

D



T. A. EDISON.

Menlo Park, N. J., \_\_\_\_\_ 187

Mr. Thruer

Well you please  
make a new diaphragm  
for this, same as the  
before I cut it. don't spoil  
this one as I want to use  
it please make it at  
once I want to take over  
early

Batchelor

finished Aug. 23 1878  
J. Thruer

Museum

Heating by Electricity

Aug 27, 1878.

J A Edison

Edison

peroxide of lead  
between



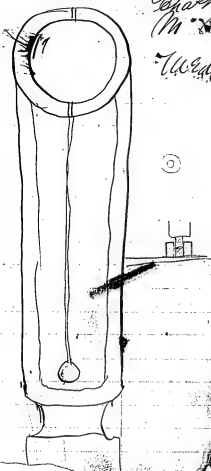
battery,

T. A. EDISON.

Menlo Park, N. J., Aug. 30<sup>th</sup> 1878

Ames  
Charles  
M. & J. J. Force

T. A. Edison



T. A. EDISON.

Menlo Park, N. J., Sep. 11<sup>th</sup> 1878

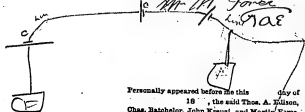
Ames; Make another  
battery like the one for  
the little engine as soon  
as you have time  
Patterson

T. A. EDISON.

Menlo Park, N. J.,

*Oct 8* 1878

*J. H. Kresel's*  
*Chas. Hatchelor*  
*John Kresel*  
*Mar. M. Force*  
*T. A. Edison*



Personally appeared before me this 18 day of Oct, 1878, the said Thos. A. Edison, Chas. Hatchelor, John Kresel, and Mar. M. Force, and acknowledged the above to be their signatures

*Portland*

Notary Public.

*Portland*  
*Portland*

*Portland*  
*Por*



T. A. EDISON.

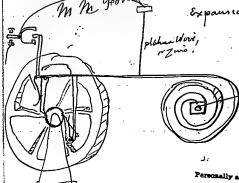
Menlo Park, N. J.,

*Oct 8*

1878

*T. A. Edison*  
*Chas. Hatchelor*  
*J. H. Kresel's*  
*Dr. Cassan*  
*M. M. Force*

Electric  
Expansion Engine,



Personally appeared before me this 18 day of Oct, 1878, the said Thos. A. Edison, Chas. Hatchelor, John Kresel, and Mar. M. Force, and acknowledged the above to be their signatures

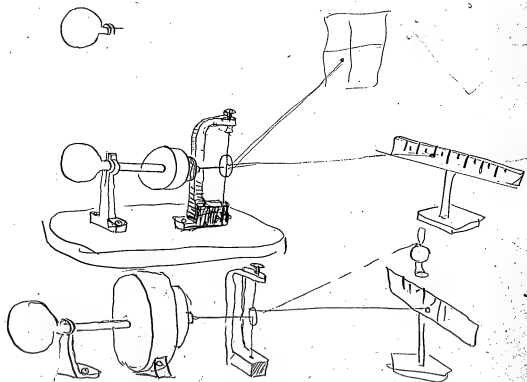
Notary Public.

~~Handwritten~~ Per 1 P. 181 P

$$\begin{array}{r} 23 \\ 4 \\ \hline 94 \end{array}$$

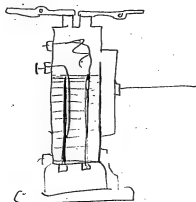
$$\begin{array}{r} 10 \\ 20 \\ \hline 60 \end{array}$$

Johnnie  
M. M. Force  
Chas. Hatch  
Tadbury

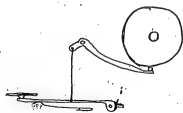


~~New Receiver~~ Oct 18. 1878

J. H. Smith  
M. H. P. Rice  
Chas. Katchev  
T. A. Edman



Penetrating Type Water  
Nov 29. 1878

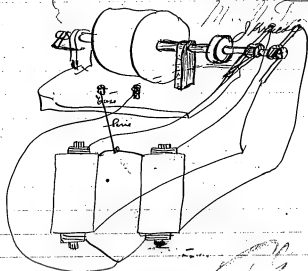


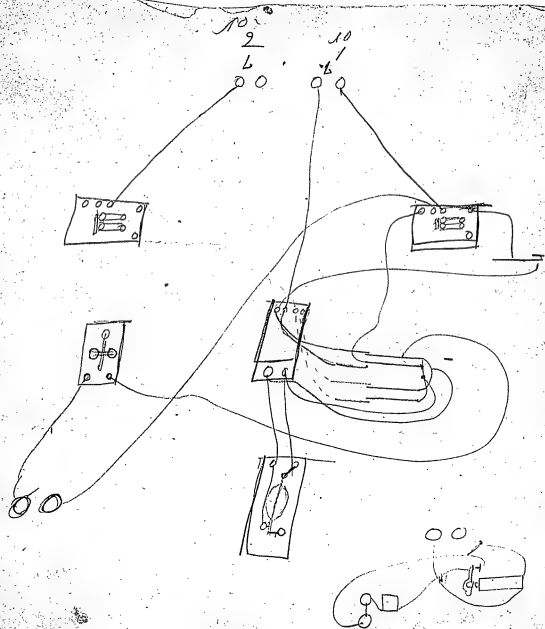
T. A. EDISON.

Menlo Park, N. J.,

Oct 29<sup>th</sup> 1878

WE  
char. catchers  
M. J. T. 1878



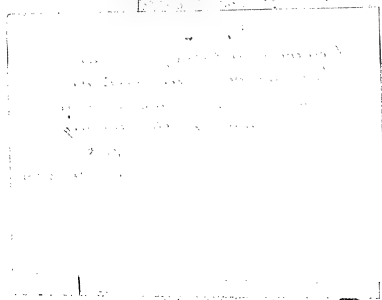
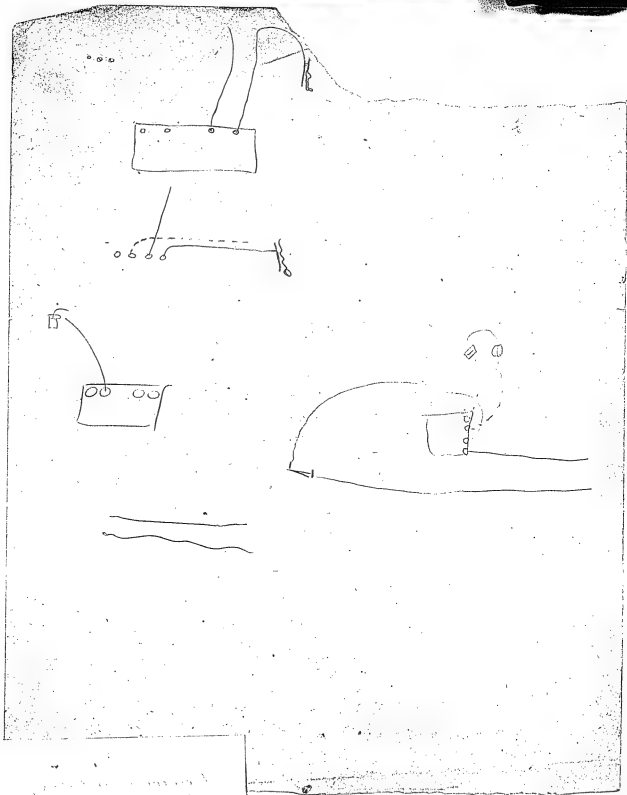


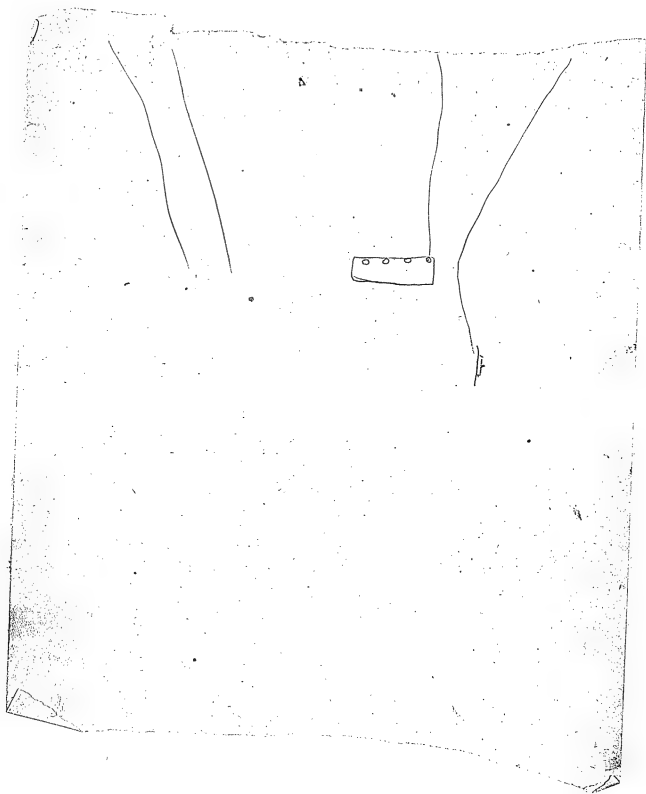
These were rec taken from our  
Book but bear no plate or  
signature. my opinion is they  
were drawn by Alch. Loring

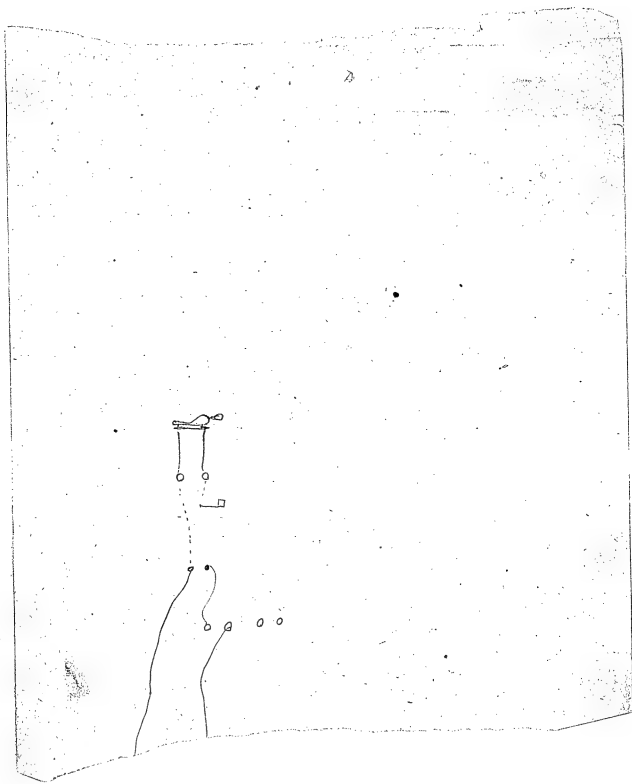
ALC

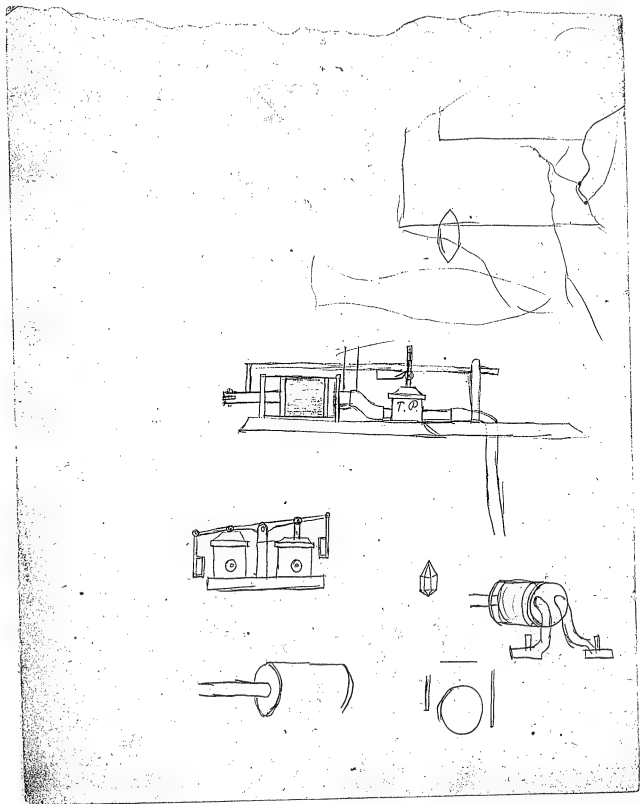
Sept 24, 1898

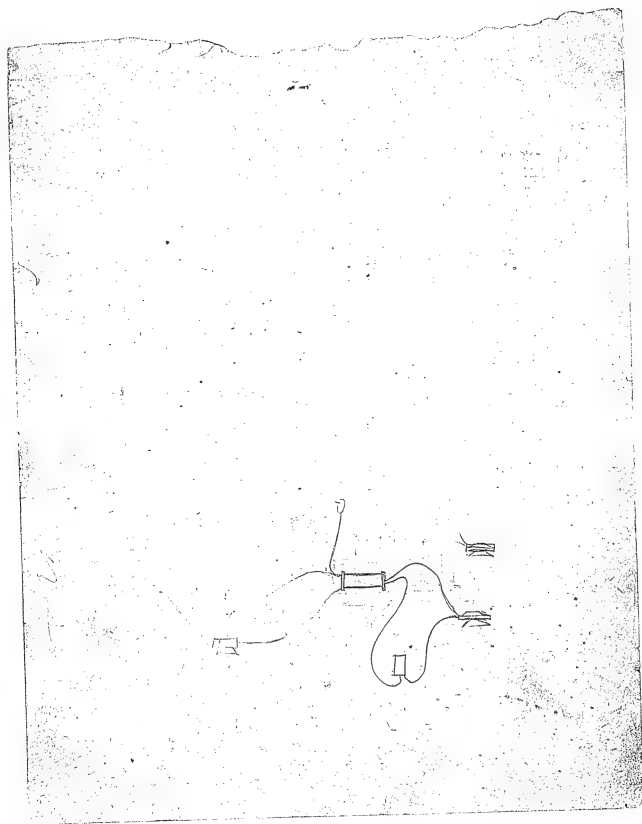




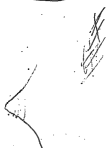








6000  
1800  
52/ 1800  
1800  
1800  
400

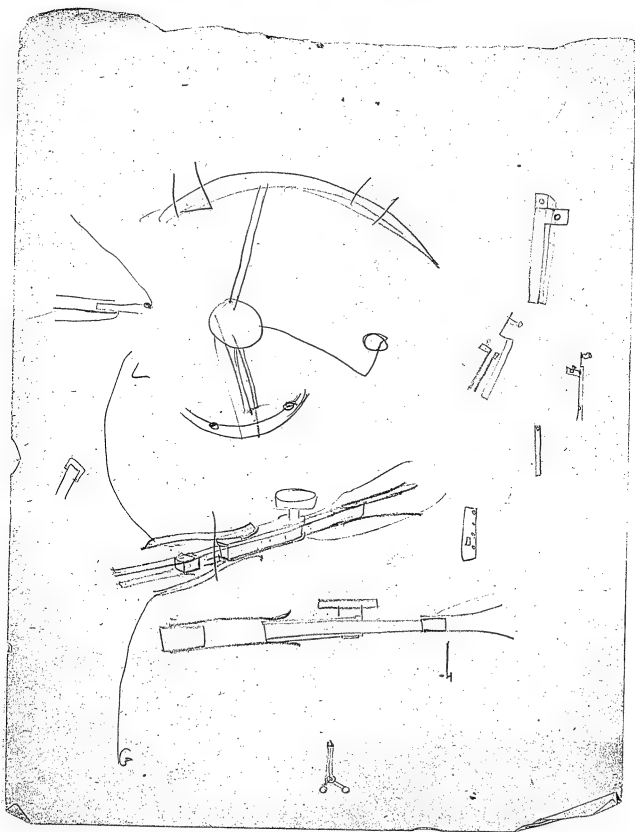


~~~~~

~~~~~

~~~~~

~~~~~



80

40  $\frac{1}{4}$   
20  $\frac{1}{2}$

10

10

6

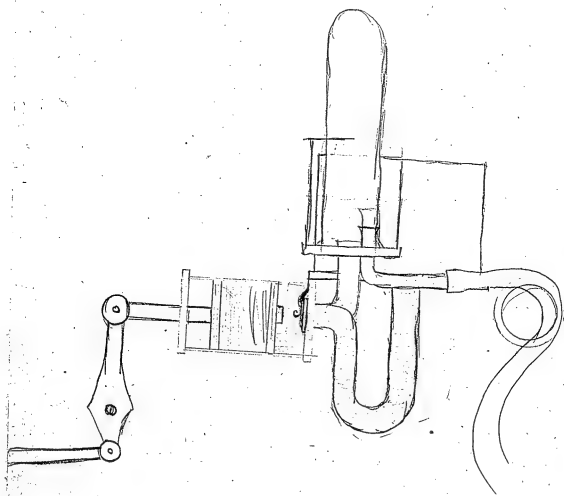
60  
30

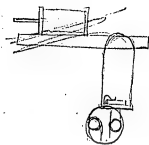
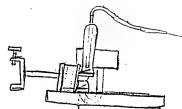
7  $\frac{1}{2}$   
60  
420  
30  
450

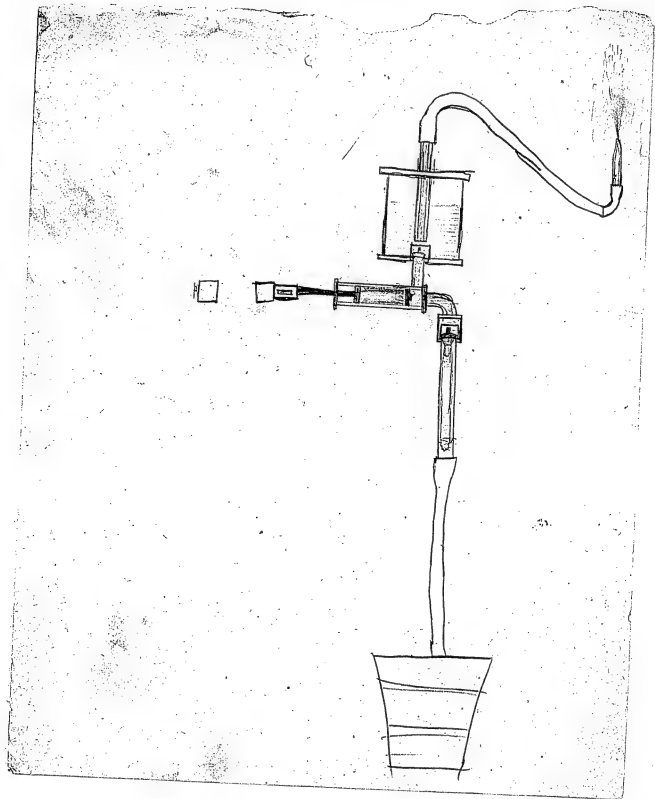
180 lb -  
500 feet, 1 second minute

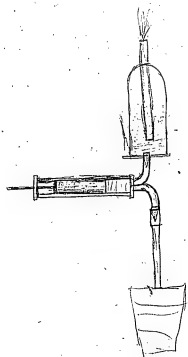
500  
100  
3-00 10

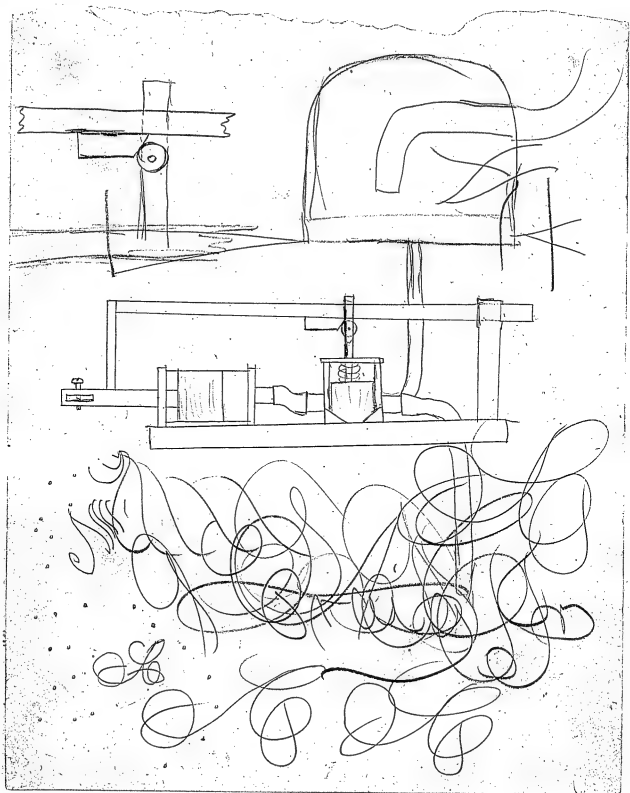












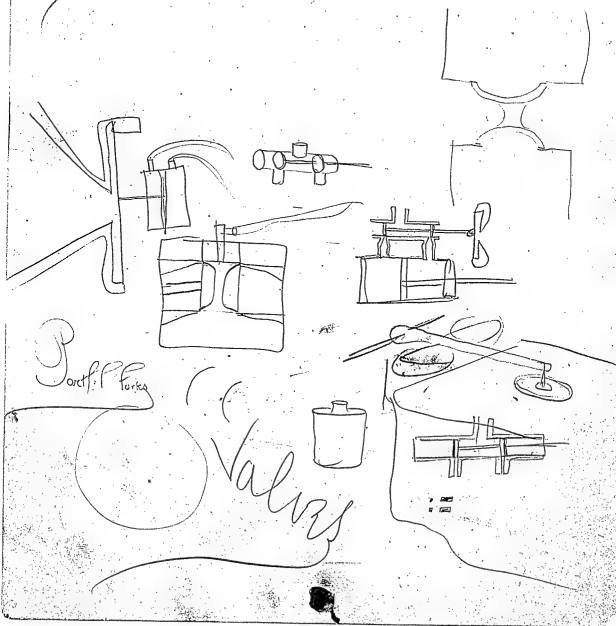
1878. Acoustic Devices (NS-78-002)

See also : "1878. Voltmeter" (NS-78-012).

Aerophon

April 30 1878

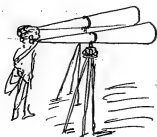
W. Edwards



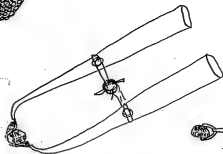
Causab

Telephonoscope

May 10 1878



Transducer



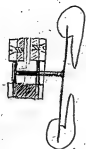
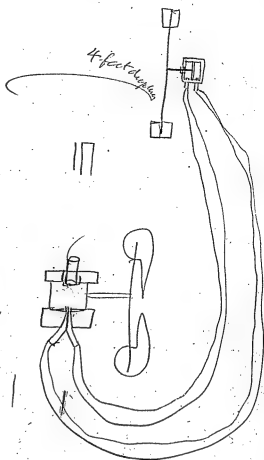
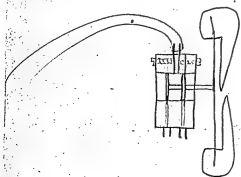


Aerophone

May 17 1898

J A Edison

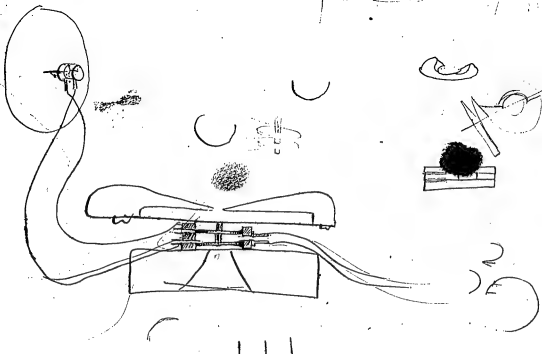
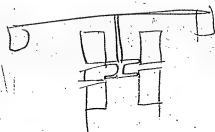
Charles Batchelor



Telephone

June 14<sup>th</sup>

Chas. Bate



T. A. EDISON.

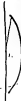
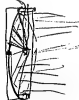
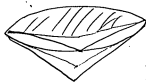
*Aurophone*

Menlo Park, N. J.

187

*Jan 19 1878*

*T. A. Edison*

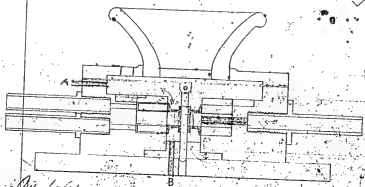


Valve for "Aurophone"

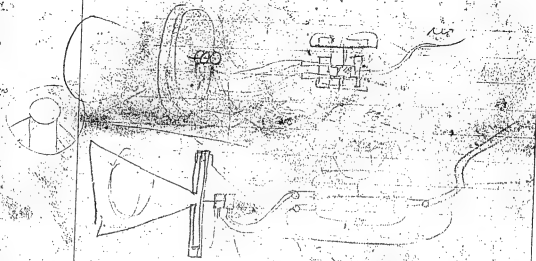
June 21, 1898

Charles S. Johnson

Johnson

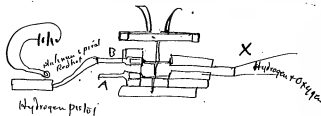


A.B. Air hole



June 21 1896

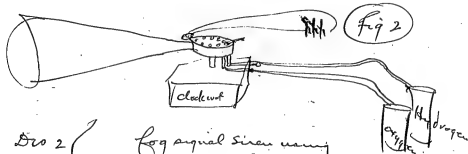
Chas. Patchin  
T. J. Edison  
John W. Cannon  
Fig 1 M. W. Jones



Des 1

May arrange it to let H. pass in B  
& Oxygen in A. & use X for pistol.

This will dispense with  
diaphragm and cylinder



Des 2

for equal sized  
explosion gases in chambers

The chambers are filled and explode by hot sp.  
so they come opposite funnel like Coll. & valves

diaphragm

June 21 1878

T. O. Odessa

Johannes

M. H. Fowler

Chas. Ketchum



6



fig 1



3



2



4



7

This apparatus

apparatus

J. P. Thawand



5



8



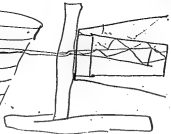
9



10



J. P. Thawand



12

J. P. Thawand



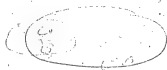
13

15



14

15 drawings

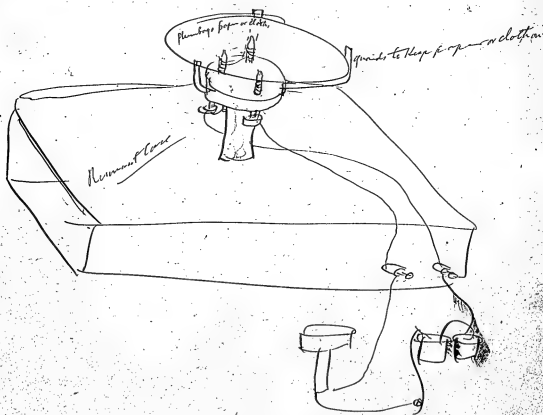


June 21 1896

T. A. Edison

Chas. Batchelor

Microphone

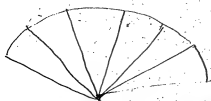


Auriphone

June 21 1878

T. A. Edison

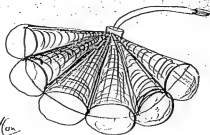
Chas. Batchelor



Push button

1/1 D

Push button

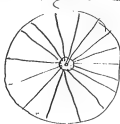


Megaphone or rather  
Aurophone



Resonator

boquet of funnels





Auriphone  
for the deaf

June 21 1898  
T. A. Edison



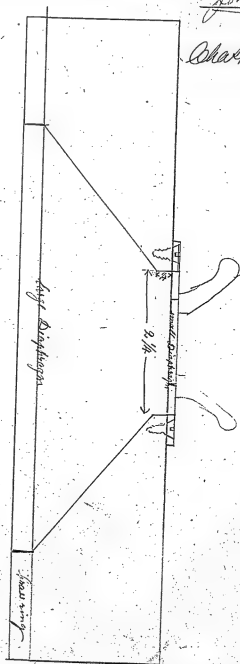
Direct Line

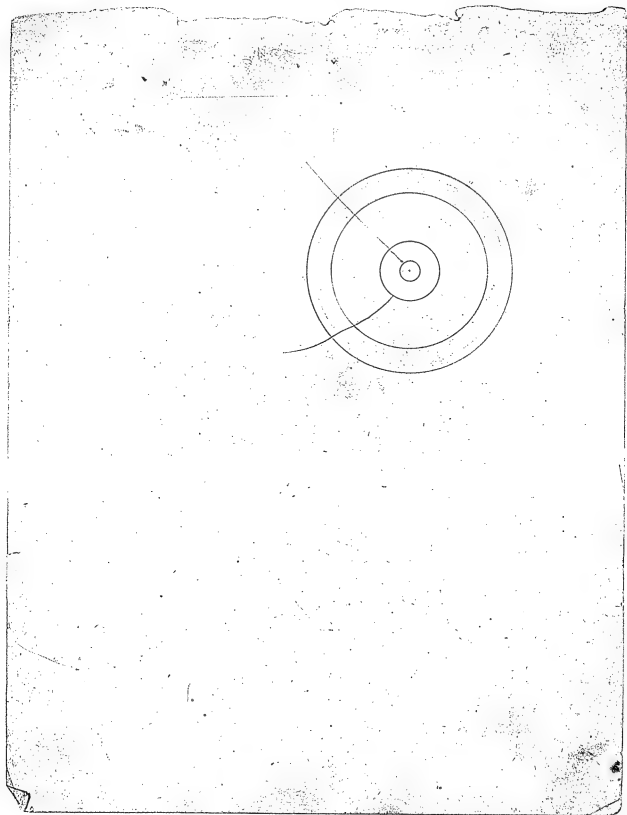


Magnophone June 22<sup>d</sup> 1878

J. House

Chas. Catlett





Chrysophone

June 23 1848  
Baldwin

Chas Batebun

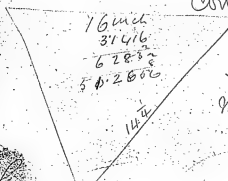
Rule for making cone

Martin M. Force

Johnnie  
J. B. Campbell  
M. M. Force

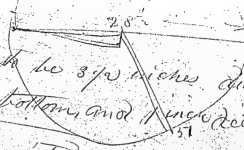


Cone to be 16 in at mouth &  
14 in to nothing 12 in deep



Strike a circle 14 1/4 radius  
measure off 51 inches on circle  
and

Large rings  
for cone



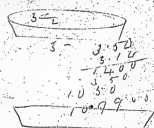
1st Ring to be 3 1/2 inches diameter on top  
3 inches on bottom and 1 inch deep making 1/2 inch

2nd 6 1/2 on top  
6 on bottom 6 5/8

3rd 9 1/2 on top  
9 on bottom

4th 12 1/2 on top  
12 on bottom

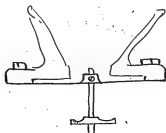
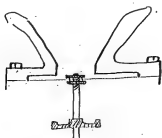
5th 15 1/2 on top  
15 on bottom



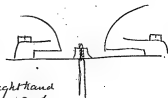
Alphonse

20th 10/15

Chapatcheto



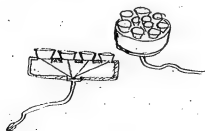
right hand side



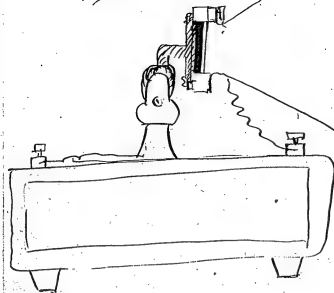
Rest: right hand  
thread on end of  
rod. screwed into  
brass plate but on  
right and screw-  
driver slot in top of  
same.

"Deaf"  
Auriphone.

June 29. 1878  
J. A. Edison



Microphone

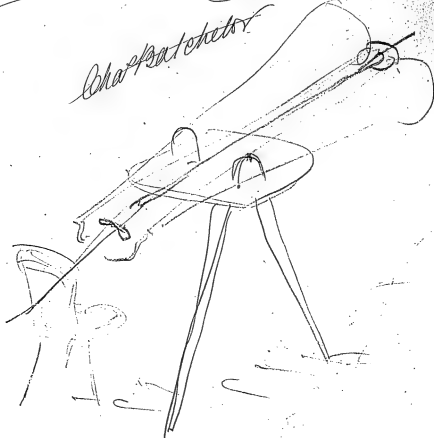


TA Edison

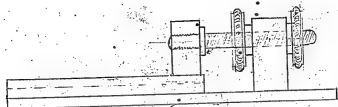
Megaphone

July 2 1878

Charl Katchet



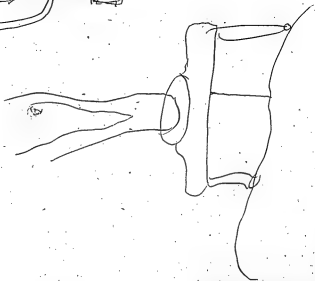
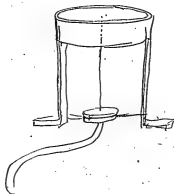
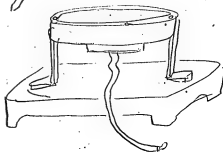
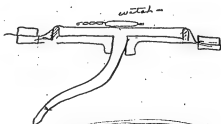
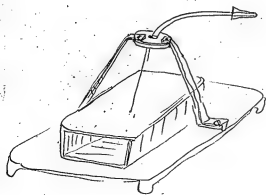
✓  
C. H. Kane July 30. 1888  
J. H. Russell





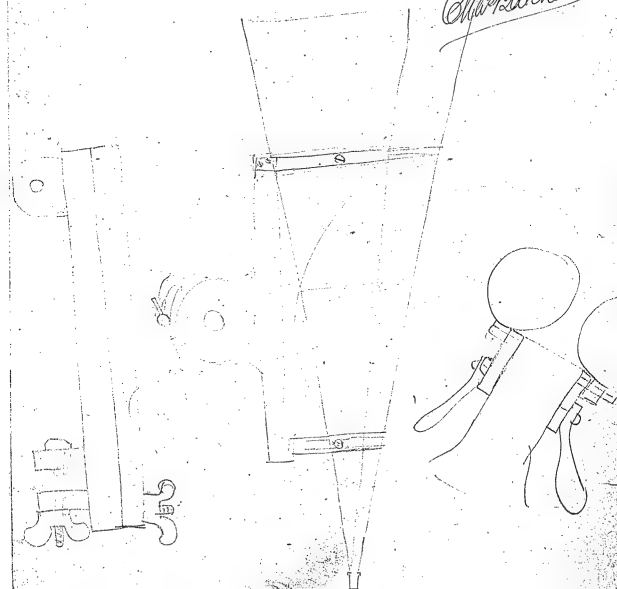
Mechanical  
Microphone

July 6 1878  
T. A. Edison



reaffirmed July 1888

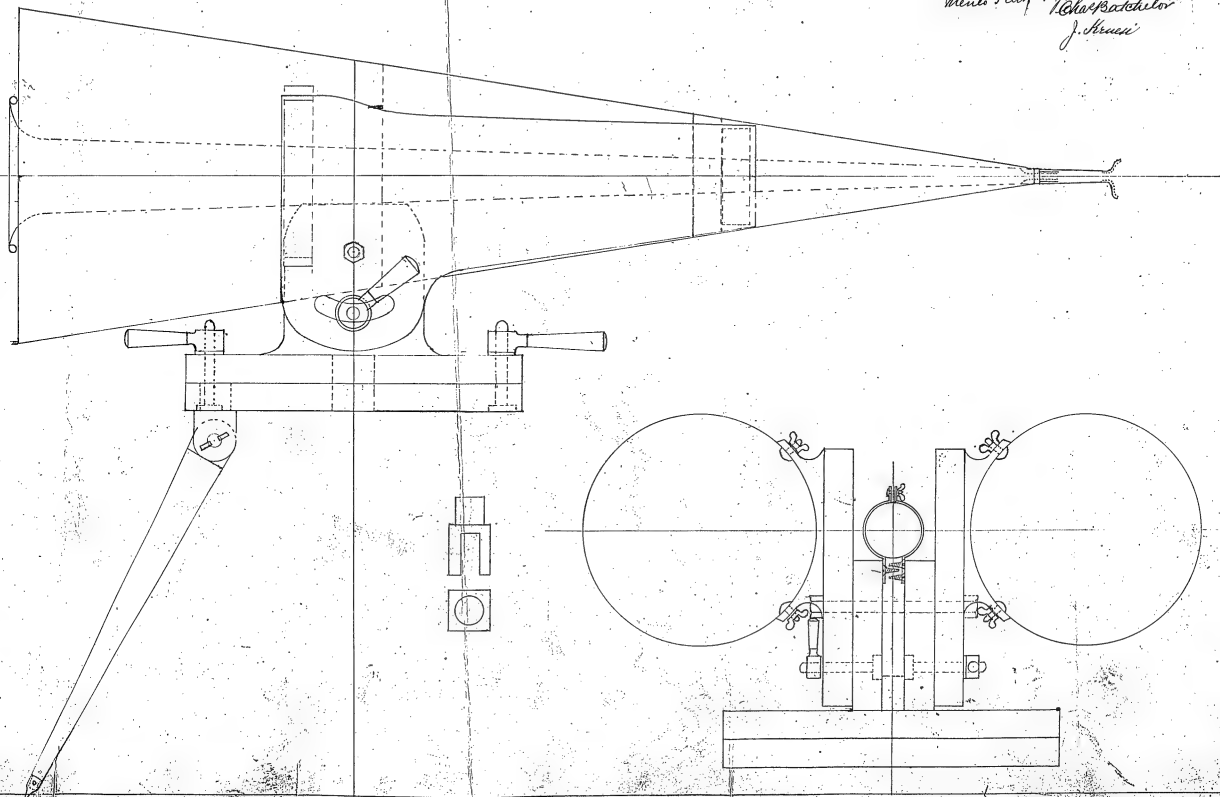
Charles Gatchelor



*Hydrogen*

FROM THE LABORATORY OF  
T. A. EDISON.  
MENLO PARK, N. J.  
U. S. A.

*Edison Megaphone  
July 27, 1878  
Memo Part 2. Charles Batchelor  
J. Menlo*



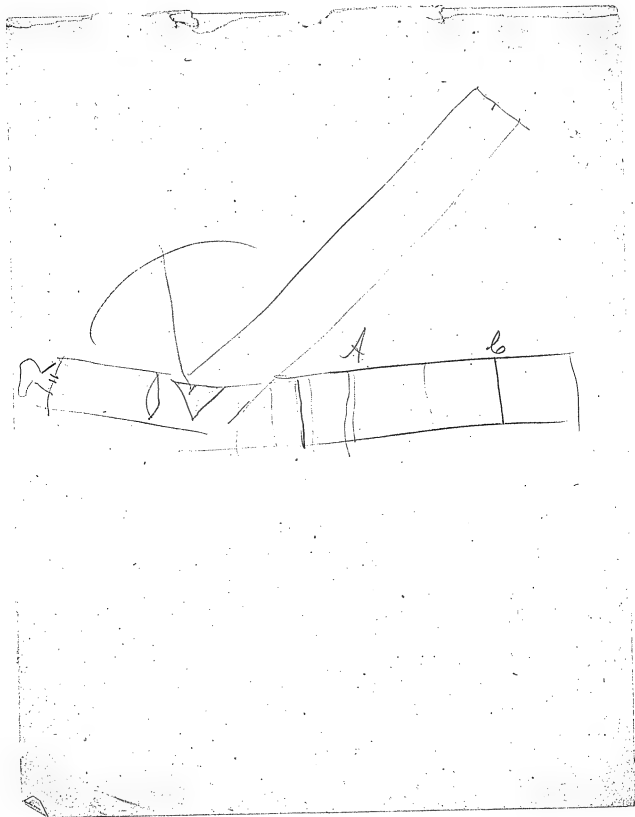
Chapatchetor

Aug. 1898

J. H. Hines

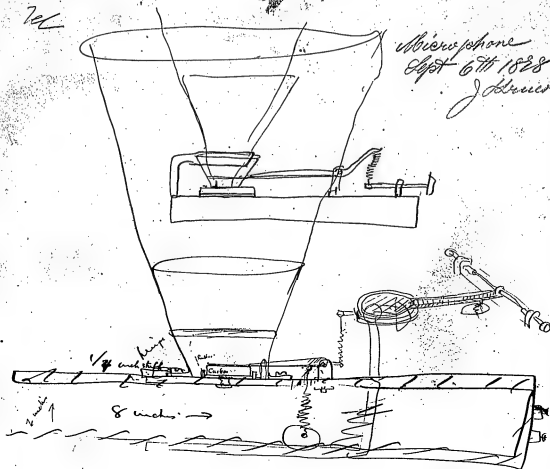
Chapatchetor



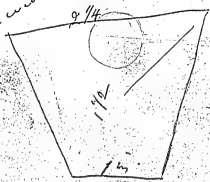


7d

Microphone  
Sept 6th 1888  
J. Brown

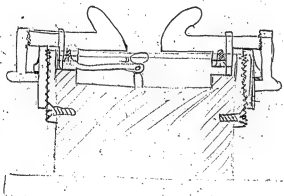


to water valve



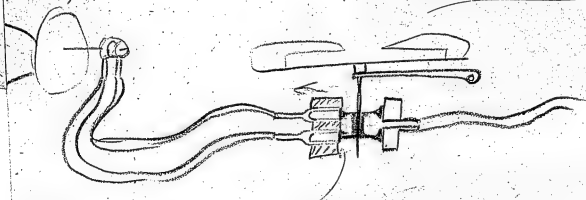
Aerophone

Sept 24 1918  
Achakate

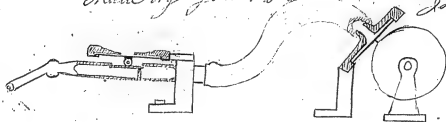


J A Carson

Aerophone Sept 24 1918  
Achakate



Made by John L. D. Nov 30th 1828  
J. L. D.

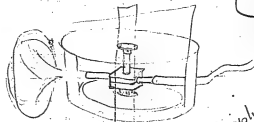


T. A. EDISON

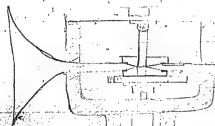
Menlo Park, N. J.

Charles Batchelor  
T. A.

187



Aerophone





Char Batchelor

Char Batchelor

Char Batchelor

Char Batchelor

Char Batchelor

1878. Carbon Rheostat (NS-78-003)

Numbered pages 1-16 precede all other notes and drawings. These pages were copied by William Carman into Experimental Researches, Vol. 4, pages 270-283.

# Carbon Resistance

Aug. 15<sup>th</sup> 1898

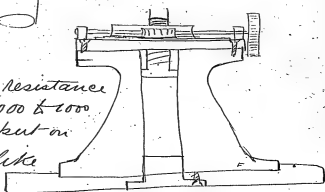
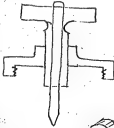
Personally appeared before me this 15<sup>th</sup> day of August, 1898, the said Thos. A. Edison, Chas. Batchelor, John Kroun, and Martin Force, and acknowledged the above to be their signatures

Chas. Batchelor

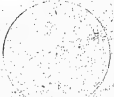
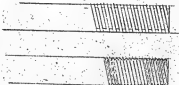
John Kroun  
Thos. Edison  
Martin Force

Personally appeared before me this 15<sup>th</sup> day of August, 1898, the said Thos. A. Edison, Chas. Batchelor, John Kroun, and Martin Force, and acknowledged the above to be their signatures

Notary Public.



In order to make a resistance box to go from 10000 to 1000 it is necessary to put on dial arrangement like sample



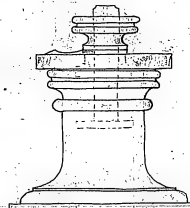
Carbon Rheostat Aug. 16<sup>th</sup> 1888

J. Kneale  
J A Edison

Martin M. Price

Personally appeared before me this day of  
10 the said Town, A. Edison,  
Chas. Batchelor, John Kneale, and Martin Price,  
and acknowledged the above to be their signatures

Notary Public

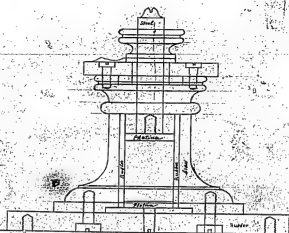
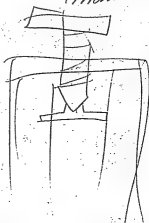


Entered on page 271 Vol. 4, 2, 1888  
1888

Carbon Rheostat Aug. 16th 1888 3

J. Kruesi  
Charpenteur

7 a Edouard  
Mantou Force



Formally approved as this  
day 10 the 16th of August  
1888 by the undersigned  
Chas. Buehler, John Kruesi, and Martin  
and acknowledged the above to be their signatures

Henry Buehler

Letter on Aug. 21/1888 4 Edouard  
Aug. 16, 1888  
Kruesi

Personally appeared before me this day of  
19, the said Thos. A. Edison,  
Chas. Batchelor, John Krouse, and Martin Force,  
and acknowledged the above to be their signatures

Notary Public.

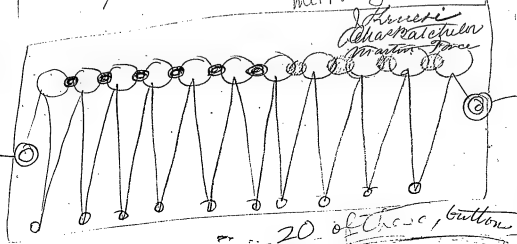
7th Edison 4

Fractious Rheostat

Shunt for,  
Fractional Balancing  
Mirror Galvanometer

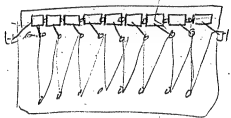
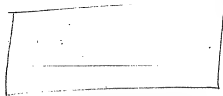
Aug 26 1878

Copied from Page 272 Vol 4 of Edison's Papers  
Box 16, NY  
170



Personally appeared before me this day of  
19, the said Thos. A. Edison,  
Chas. Batchelor, John Krouse, and Martin Force,  
and acknowledged the above to be their signatures

Notary Public.



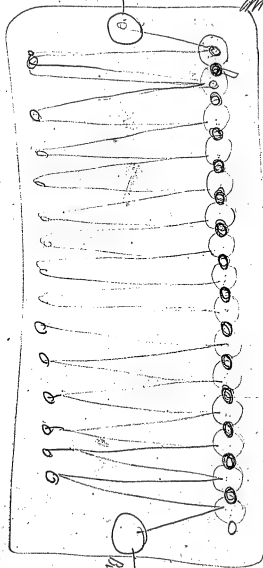
Shunt  
Shunt

Brilliant Brilliant Brilliant Shunt

Edison's

Aug. 27. 1878

Johnnie 5  
Otha Hatchel  
J. A. Edgar  
Martin



fractional plate

between page 272 Dec 4. Bill Rumsden

May 16, 1878

W. Rumsden

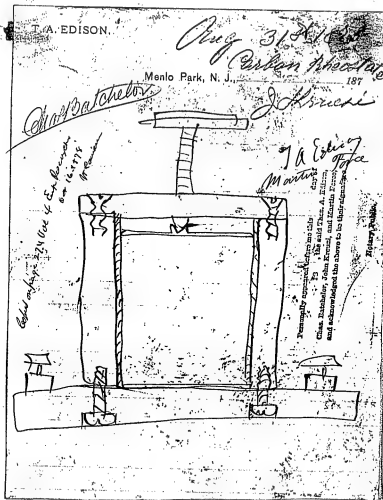
15

Nothing lost

Personality appeared before me this  
day of  
1878, the said Thos. A. Edgar  
Otha Hatchel, Martin, and acknowledged the above to be their signatures

Notary Public





Respectfully prepared before me this  
 31st day of August 1877  
 at Menlo Park, N. J.  
 Charles Batchelor, Notary Public,  
 and witnesses signed the above to the said T. A. Edison.

Edison Patent



# Edison Carbon Resistance

Sept 4<sup>th</sup> 1898

Charles Batschelor

135 Humbugged Cinn

~~Tested on~~ Marion Fox  
~~Marion Fox~~ John E. Callan

These tests taken on 1 cell Callan on Sept.

135 Discs Deflec. 9 1340 ohms

Screw moved down 7/6.

135 — Deflec. 40 120 ohms

J. Humbi

1/2 { 67 Discs. Deflec. 3 — 3760 ohms

Deflec. 46 — 60 ohms

Personally appeared before me this 10 day of Sept 1898, the said Charles Batschelor, John E. Callan, and Marion Fox, and acknowledged the above to be their signature.

Notary Public.

3/4 { 101 Discs Deflec 3 3760 ohms  
Deflec 42. 90 ohms

Quad  
Carbon Rheostat

1/4 { 34 Discs Deflec 3 3760 ohms.  
Deflec 30 ohms.

34 Discs  
Same with 3 c

4950 ohms  
37 ohms,

9520  
9220

The one cell tests are probably unreliable owing to slight deflection

67 Discs Deflection 7. 5600 ohms  
" " 69. 67 ohms

420  
9820

101 Discs. Deflect 67. 107 ohms  
" " 5 1/2 6706

5600  
4950  
6300

5600  
6706  
1806  
1106

Witnessed & signed  
Sept 21, 1898  
J. E. Callan

Carbon Carbon Load Resistance

Sept 4 1898

Went to test 19 with pressure

Discs used last night - No 3 coil <sup>Drum</sup> Well Callan

Deflect  $1\frac{1}{2}$  with pressure 34 Martin Ford

~~up~~ make solution that will give  $\frac{1}{2}$  this  
and try it

Water 4<sup>00</sup>

*Dextrose* 183

Plumbago  $\frac{1}{2}$  oz

This test

446

Water 40

Dextrine.  $1\frac{1}{2}$

Flumbeago  $\frac{1}{2}$

This tests  
 $1\frac{1}{2} - 22$

Water 4.5

Desirée 1<sup>st</sup>

Limburgo 2

22 - This

test  
This was rubbed  
off a little more than  
the last

Water - 4

Sextine

Plumbago

18

46  
 Referred from Page 275. Vol. 4 Ex. 100  
 Dec. 21/19

Personally appeared before me this \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_\_\_, the said Thos. A. Feltz, Thos. Bachelor, John Liviani, and Martin Perry, and acknowledged the above to be their signature.

Secretary of the

## Edison Carbon Grid Resistance

Sept 6 1898

old

new

J. Hume  
Martin Hume

Chas Patchett  
Tadmon

Scraped

1-23  
2-57  
3-313  
4-17+  
5-17+  
6-24  
7-54  
8-58  
9-24  
10-28  
11-18+  
12-28  
13-28  
14-30  
15-28  
16-28  
17-28  
18-18  
19-20  
20-20.

$$\begin{array}{r} 29 \overline{) 584} \\ \underline{58} \phantom{0} \\ 0 \phantom{0} \end{array}$$

$\frac{876}{29}$  average ofms

1 — 220 — 80 120  
2 — — 140  
3 — — 97  
4 — — 326  
5 — — 33 — 206  
6 — —  
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19 — —  
20 — —

Copy of  
the report of  
Glad. Watkins  
and acknowledgment  
of the above to the  
signatures

11/19/94  
Barnes

Personally appeared before me this 19th day of June, 1919, the said Chas. A. Brown, Chas. Batchelor, John Kruml, and Harriet Davis, and acknowledged the above to be their adventure

Website: [www.ptsd.va.gov](http://www.ptsd.va.gov)

60 pages on p 276 Vol 100 J. Nov 21, 1914  
M. P. ...

1878  
M. P. ...

Prothonotary Notarized Sept 11th 1828

Personally appeared before me this day of  
13 the said Chas. A. Edison,  
Chas. Betshelm, John Kreuz, and Martin Force  
and acknowledged the above to be their signatures

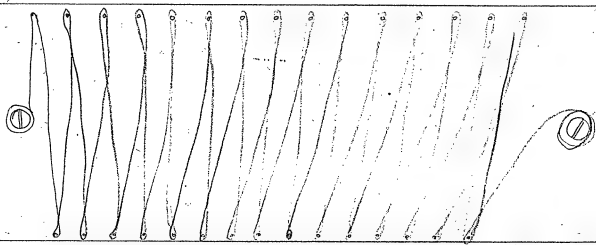
Notary Public.

J. A. Edison  
Chas. Betshelm

J. A. Edison  
Martin Force

Personally appeared before me this day of  
13 the said Chas. A. Edison,  
Chas. Betshelm, John Kreuz, and Martin Force,  
and acknowledged the above to be their signatures

Notary Public.



Copied on page 792 Vol 4 of the Researches  
per 21. 1874  
McCumby

Cable Resistance

Sep 12 1898

Quadruplex

Martin Ford Johnson, Madison

Edna Mattheis

Geo E. Carman

3 cells in each Battery	Brady's Lead No. 1	
100 Pounds of Lead	250 pounds	
9	4160	Series length 1 1/8 miles
17 1/2	2160	
75 — 4	9170	" " 1 1/2 "
15	2500	
50 — 22	1600	1/2 miles length to full 1 1/2
48	450	
25 — 28	1153	2 1/2 miles of Series
30	373	3 1/2 miles of Series

75 — 7 1/2 — 1730  
 2 1/2 — 4170

Slant for 23 miles

Copied on P. 275 Vol 1 Ed. 1  
 over 21. 1898  
 M.C.

Sept 13. 1898

22 = 1640

Primary deposits are the  
 clay of  
 the sand and fine A. E. E. E.  
 Clay. The clay is the same as the  
 and is deposited in the same way as the  
 clay of the sand and fine A. E. E. E.

Callum Resistance for Lead Sept 13 1888

Personally appeared before me this 13th day of Sept 1888, the said John A. Callum, John Kreisel, and Martin Jones, and acknowledged the above to be their signatures.

John A. Callum  
John Kreisel  
Martin Jones

Notary Public.

20 Cells Callum  
75 discs of 2 1/2 Numbago made from standard  
75 discs with pressure 75 deg. 1440 ohms  
without pressure 62 deg. 2840 ohms

tested on 3 wire -

75 discs with pressure 8 1/4 - 1440  
4 1/4 - 2840

3 cells Callum on 1 coil again

75 discs with pressure 24 1/2 1540  
without pressure 14 2870

5 hours after  
Take test at 2 p.m.

One cell 3 cells Callum 25 = 1540 ohms  
75 = 2690  
20 cells Callum 75 1440  
62 2720  
20 cells 3 wire 49 1400  
45 2670

35 min after  
24 1/2 = 1440  
15 1/2 = 2690  
7 1/2 1400  
63 2690  
4 1400  
5 2670

Looked over Page 279 400, 410 on 21-2588

Personally appeared before me this 13th day of Sept 1888, the said John A. Callum, John Kreisel, and Martin Jones, and acknowledged the above to be their signatures.

Notary Public.

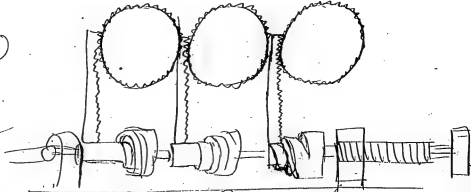
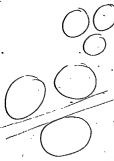
# Carbon Rheostat for Quadruplex

Sept 14<sup>th</sup> 1898

Chas Patchett

J A Edison  
J. H. Johnson  
Milton Force

Cotched on page 280 Pac & Eng Reviews  
over 2-1, 1898  
R. H. Johnson



Racks worked by Cam, so that each one goes to full distance before another commences and the last one starts back first

Permanently appeared before me this 13<sup>th</sup> of the said 1898. A. H. Johnson, Chas. Patchett, John K. Kumpf, and Martin Force, and acknowledged the above to be their signatures

Notary Public





Custom Resistance for  
Quadruplex

Sept 16, 1898  
Taldora  
Chas. B. Bickel

After taking out the 75 discs and pressing  
crick one singly and then all together  
we took the test

	with	without
30 lbs. Ball 1 End	39 790	17 2390
20 lbs. Ball 1 End	52 720	6 2390
20 lbs. Ball 3 End	13 720	5 2390

Personally appeared before me this day  
10, the said Chas. A. Bickel,  
Chas. Bickel, John Kruel, and Martin Wozniak,  
and acknowledged the above to be their signature.

Notary Public

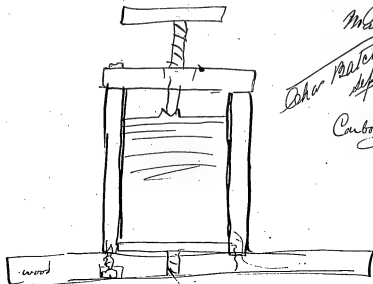
Sept 18th  
100 Discs each pressed singly and then

Discs	Cal	1 end	with	without	17	3070
3	Sept 21st		35	823	10 1/2	4070
1	" "		75 1/2	776	49	3900
"	" 22		75 1/2	740	60	2420
"	" 23		38	760	14 1/2	2690
3	" "		14 1/2	240	10 1/2	4080
"	" 25		37 1/2	80 1/2	10 1/2	4080
"	" 26		37 1/2	80 1/2	6	6600
"	" "		30	1145	7	6100
125 2000	" 27		31	1100	11 1/2	37

Chas. Bickel, John Kruel, and Martin Wozniak

Notary

~~Speaking Telephone experiment with magnet of Edison~~ Jan 186



J A Edison

J Hunsie  
Martin Force

Edw Batchelor  
Sept 28 1875

Custom Rhetical

Any of  
Personally appeared before me this  
19<sup>th</sup> day of June, A. D. 1875,  
Edw. Batchelor, of the County of  
and State of New York, and acknowledged the above to be his signature.

Henry J. Ellis



Looked on Page 24 & Voc 4  
Exp. Research Oct 21 77  
M. C. Cramer

Apparatus for Testing the Resistance  
of Carbon Sept 19th 1898

J. H. P. H. H.



Chas. Batchelor

\* weight one gramme

Carbon Resistance for  
Quadruplex

Sept. 29

Sept 29 to 1878

Sal

Chas Ketcher

E. C. Johnson

M. J. Jones

125 Discs Each pressed singly and then together

3 also Calc 1 coil

Orbit Pressure With Pressure

after standing 12 hrs in sun 30 - 1120 - 13 - 3120

Sept 30 7 AM 30 - 1120 - 10 - 2930

" 430 PM 31 - 1060 - 11 1/2 - 3490

" 52 " 30 1/2 - 1070 - 11 - 3610

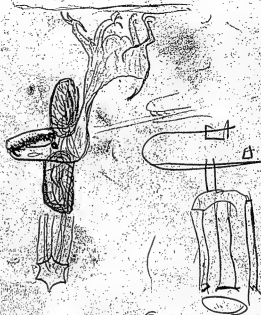
" " 30 - 1120 - 10 1/2 - 3770

standing 12 hrs in sun 30 - 1120 - 10 1/2 - 3770

Oct 2 31 - 1010 - 13 - 3750

" 7th 830 30 - 1030 - 14 - 2720

" 11th 1130 30 - 1080 - 9 1/2 - 3370



1878. Chemophone (NS-78-004)

Chemical

June 21<sup>st</sup> 1878  
Johns

Copper x

Zinc v

Lead v

Iron v

Carbon @

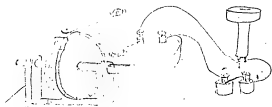
Platinum v

Gold v

Silver v

Aluminum v

Nickel @



3 days

W. Carey, B. 11

Station	Time
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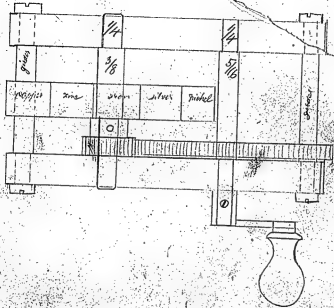
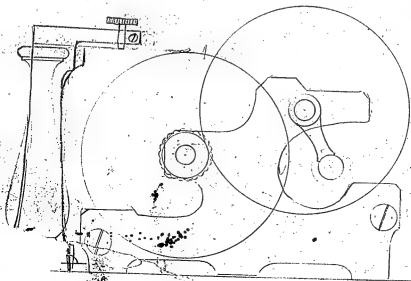
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46 1/2  
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495 1/2  
60  
555 1/2

1200  
555  
645

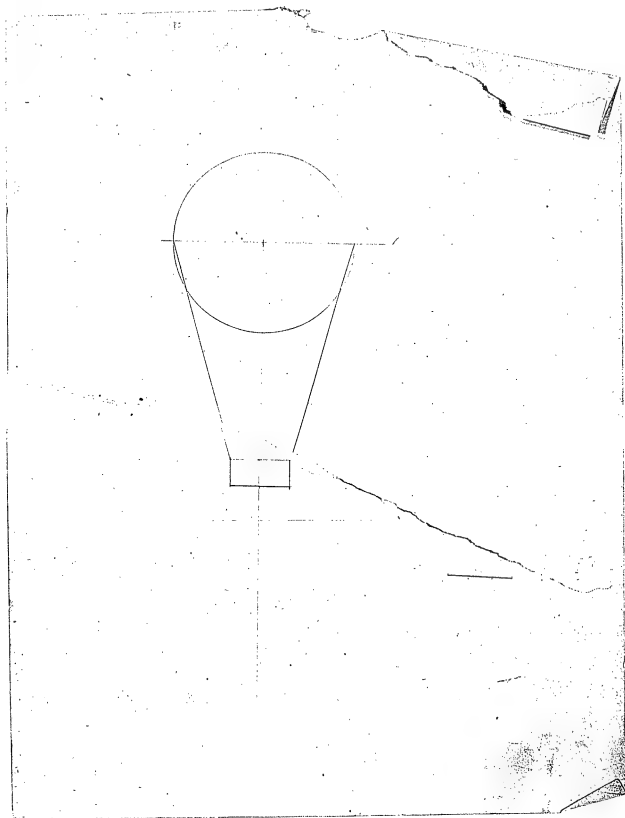
Charnophone June 21st 1888

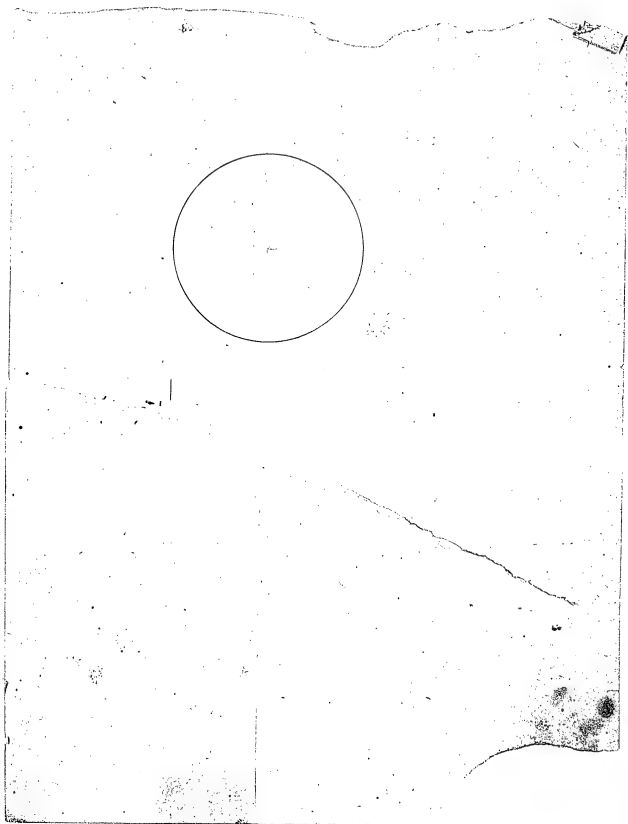
J. H. K. K. K.

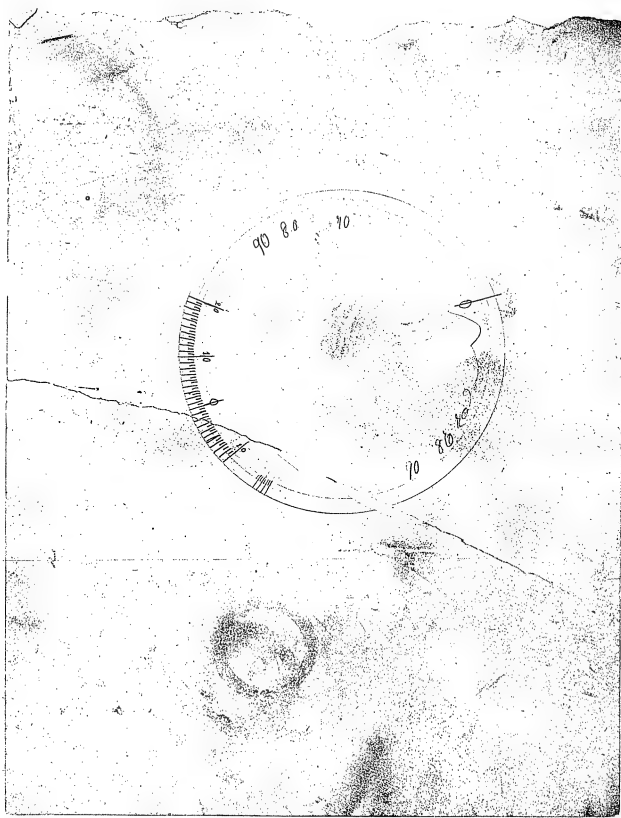
Charnophone











1878. Electric Light (NS-78-005)

Numbered pages 1-6, relating to electric engines, precede all other notes and drawings. These pages were copied into Experimental Researches, Vol. 6, pages 1-4. This folder also contains draft sketches for electric light caveats, some of which were copied into Experimental Researches, Vol. 5, pages 69-86.

Original drawings

Electric Engine  
for Lamp Sept 1878

Wm. Carman

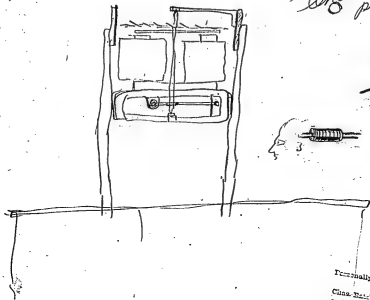
7th Edison

Chas. Patchett  
prev. to Sept 20<sup>th</sup> 1898  
H. H. H. H.  
H. H. H. H.

Batch 200 to Sept 20

Memorandum to Secy  
J. H. Hume  
Martin Force

*I think  
Martin Force*



Formally appeared before me  
China, Hatcher, John H. Hatcher, and Joseph H. Hatcher  
and acknowledged the above to be their signature

Notary Public

Electric Eng for Genl

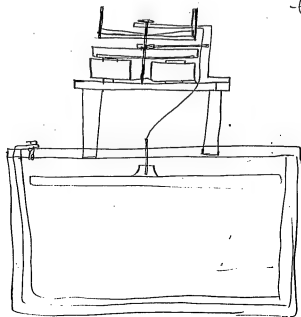
Express on Page 1 Vol 6 Exp Research

Electric Lamp Sept. 8th 1858

2

Chas. Batchelor

Ja. Edgar  
Martin Force



Examination of the  
to the  
Glass Enclosure, and the  
and the whole into the  
the whole.

History of the

Referred on Page 1 to 6 of the  
Gen 15. 1878

W. R. R. R.

Copied on page 2 Vol 6 Ex. Records

Aug 16, 1898

Memo

Miscellaneous

Aug 29 1898



T.A. Edison

Johnson

Charles Hatchelor

Martin Force

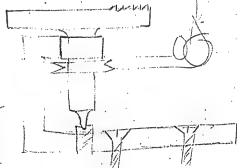
Tunnel funnel



Perforate



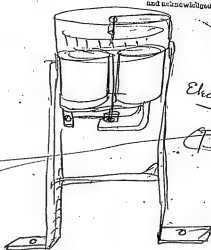
Batteries for



T.A. Edison

Electrically equipped to draw water from the ground  
to the surface of the water. A. Edison,  
Chas. Hatchelor, John Johnson and Martin Force  
and acknowledged the above to be their invention.

Notary Public.



Electric Draft Pump



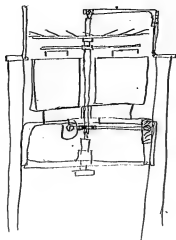
Electric Engine for lamp

Sept 9<sup>th</sup> 1878

Chas. Ketchum

J. A. Edison  
Johnesville  
Martin House

Copied on page 3-4 Oct 6 Expt. Records of 1878  
W. R. Mendenhall



Personally appeared before me this day of  
1878, the said John A. Edison,  
Chas. Ketchum, Johnesville, and Martin House,  
and acknowledge the above to be their signatures.

Notary Public.

Break—

Royalty

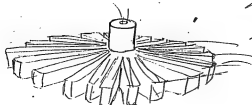
Royalty

Electric Engine for camp

Apr 21 1898 5  
J. H. Edison

Chat. H. H. H.

No. 11951  
Will you please make a  
line for this battery that has all side  
surface something like this with no  
bottom surface harder  
but all side surface



Batchelor

$$\begin{aligned} X &= \text{internal resistance} \\ X + 1.44 \text{ Ohm} &= 43.30 \text{ degrees} \\ X + 1.44 \text{ Ohm} + 1 \text{ Ohm} &= 32.20 \end{aligned}$$

20.55 Ohm

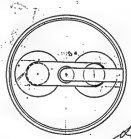
Copied on page 30 to Exp. Roscardew  
Oct 15, 1898  
Wm. Leammann

Presumably approved as the day of  
19  
Other. The following are the names of the  
and acknowledged to be the same as the  
H. H. H. H.

Graham P. H. Vol. 6. Exp. Research  
 Oct 16. 1878  
 1700 Angstrom

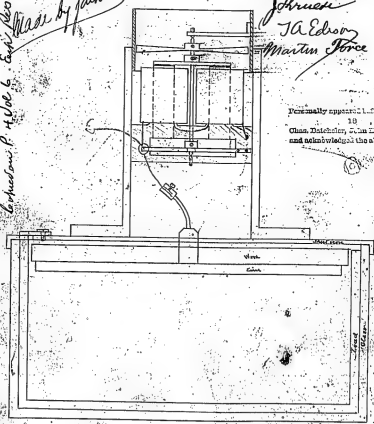
Electric draft lamp.

Made by Jackson



Sept 9<sup>th</sup> 1878

Albert Ratchel  
 Johnson  
 J. A. Edison  
 Martin Force



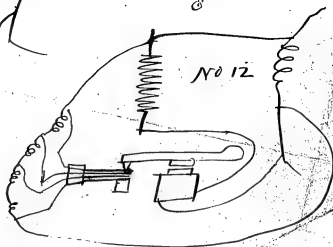
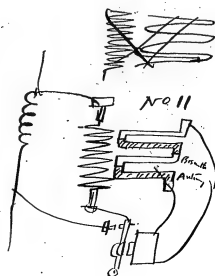
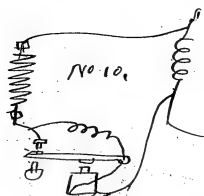
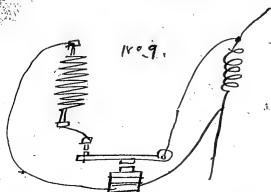
Formally appeared before the day of  
 30 the said Court, A. R. Ratchel,  
 John Johnson, J. A. Edison, and Martin Force  
 and acknowledged the above to be their signatures

Henry Folger.

Sept 8. 1878.

Electric lamp

J. A. Edison



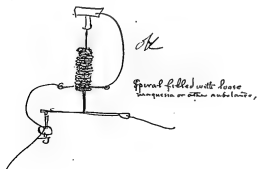
T. A. EDISON.

Sept 27 1878

Menlo Park, N. J., 7 A Edison 187

add, Electric Light Circuit.

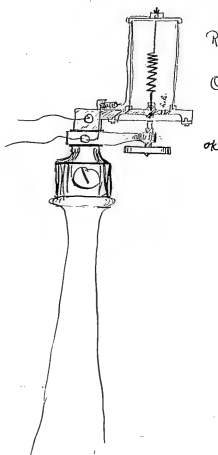
No. 3.



T. A. EDISON.

Carver No. 3

Menlo Park, N. J., Oct 1 1878



Oct. 1878.

T. A. EDISON.

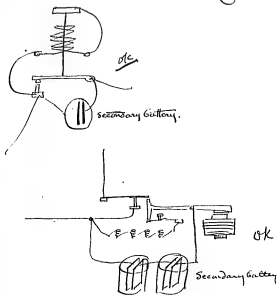
Patent No. 3.

Electric Light

Menlo Park, N. J.,

Oct 1 1878

T. A. Edison



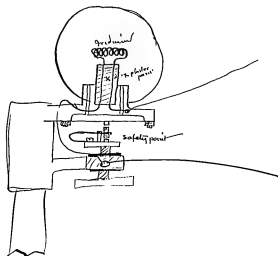
T. A. EDISON.

Patent No. 3.

Menlo Park, N. J.,

Oct 1 1878

T. A. Edison



T. A. EDISON.

3<sup>rd</sup> Canest

Menlo Park, N. J.,

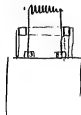
Oct 1 1878

T. A. Edison

Spirals.



Safety Catch



Safety Catch

T. A. EDISON.

3<sup>rd</sup> Canest

Menlo Park, N. J.,

Oct 1 1878

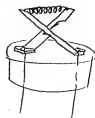
T. A. Edison



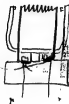
Safety Catch



do



Safety Catch

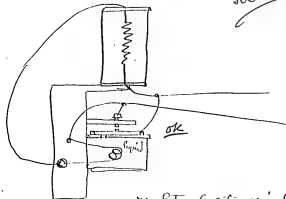


T. A. EDISON.

*Electric light*  
*document*

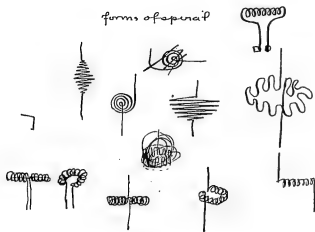
Menlo Park, N. J., Oct 1 1878

*T. Edison*



regulating by electric spiral  
in air or liquid.

forms of spiral



T. A. EDISON.

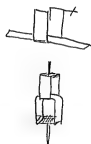
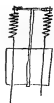
*Cont 123*

*T. Edison*

Menlo Park, N. J.,

Oct 1, 78

*form of spiral*  
*Electric light*





T. A. EDISON.

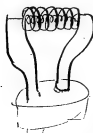
*Carrot No 3  
Radio*

Menlo Park, N. J.,

*Oct 1*

*Talman*

188

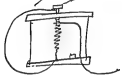
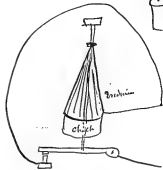


T. A. EDISON.

*Carrot No 3,  
15th Oct 1887*

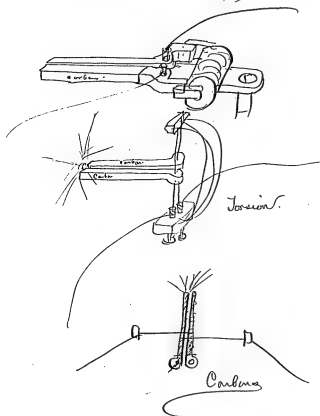
Menlo Park, N. J.,

187



T. A. EDISON.

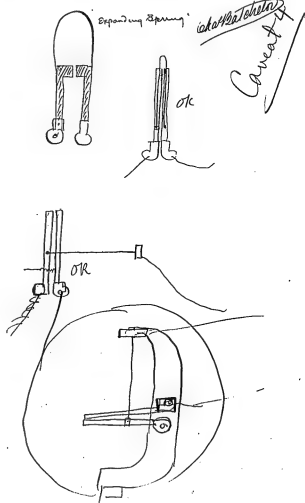
Convent 4. Electric Light  
Menlo Park, N. J., Oct 3<sup>rd</sup> 1876  
*Shakatchewan*



T. A. EDISON.

~~81~~

Electric Light  
Menlo Park, N. J., Oct 3<sup>rd</sup> 1876  
*Shakatchewan*  
*Convent 4*



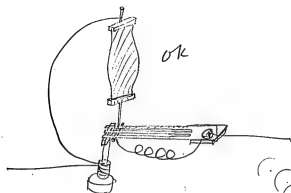
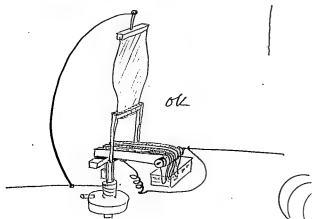
T. A. EDISON.

Patent 4

for Electric Light

3ae. Menlo Park, N. J., Oct 3 1878

*Edison's Patent*



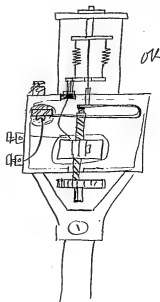
T. A. EDISON.

Patent No 4

No 1

Menlo Park, N. J., Oct 3rd 1878

*Edison's Patent*



T. A. EDISON.

1878

Menlo Park, N. J.

1878-12

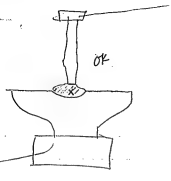
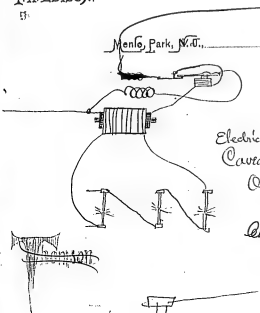
1878-12

Electric light,  
Circuit No. 4

Oct 4 1875

T. A. Edison

Edison & Menlo Park



T. A. EDISON.

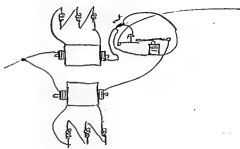
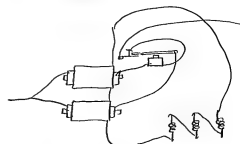
Electric light  
Circuit No. 4

Menlo Park, N. J.

Oct 4

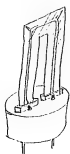
1878

T. A. E.  
Edison & Menlo Park

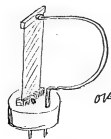


T. A. EDISON.

Camet 4 Menlo Park, N. J., Oct 4 1878  
Electrical Supply TAE  
Chas. Batchelor



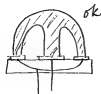
OK



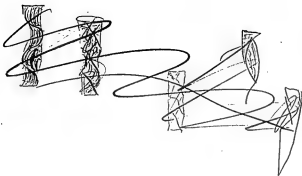
OK



OK



OK



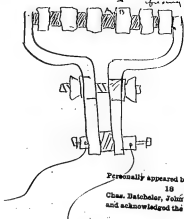
T. A. EDISON.

Miscellaneous Menlo Park, N. J., Oct 4 1878  
Chas. Batchelor  
Thermopile worked by steam power  
John Keese  
J. E. Carson  
'm' m Force  
Operated by power



Heat this

A. Aluminum metal or oxide  
B. Carbon, iron or high  
resistance material



Personally appeared before me this 18th day of Oct. 1878, the said Thos. A. Edison, Chas. Batchelor, John Keese, and Martin Force and acknowledged the above to be their signatures.

Notary Public.

T. A. EDISON.

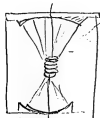
Carvet No 4  
Electric Light

Menlo Park, N. J.

Oct 5 1878

JAE

Chas. Ketchum



I propose to use reflectors in the bottom and top of the straight glass holders, or in the case of a globe place the incandescent conductor in the center so it will be in the universal focus. Perhaps I can use something on the glass that will radiate well, thus throwing back the heat & allowing the light to pass through,

7A E

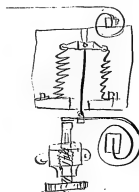
If Sodium were so improved, I propose to use a cable composed of a number of exceedingly fine wires twisted together, instead of a single strand with the same amount of metal as the stranded cable.

T. A. EDISON.

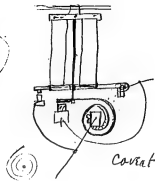
Electric Light  
Carvet No 4

Menlo Park, N. J., October 5 1878

Chas. Ketchum



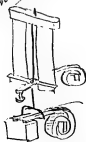
Cove



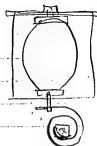
Carvet.

T. A. EDISON.

*Electric Light  
705 Menlo Park, N. J., Oct 5 1878*



*use flattened spirals*

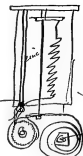
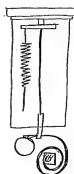


ohm	$\frac{1}{2}$ in
1	2
2	4
4	8
8	16
16	32
32	64
64	128
128	256
256	512

T. A. EDISON.

*Carver 1874*

*Menlo Park, N. J., Oct 6 1878*  
*Electric Light T. Edison*  
*Menlo Park, N. J.*



*OK*

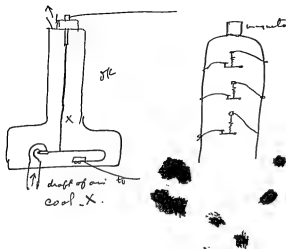
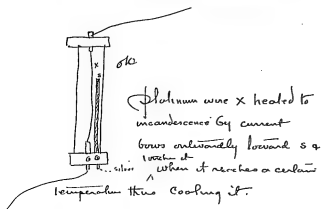
T. A. EDISON.

Convent No. 4.

Menlo Park, N. J., Oct 8 1878

J. A. P.

Chas. Ketchum



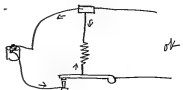
T. A. EDISON.

Convent No. 4

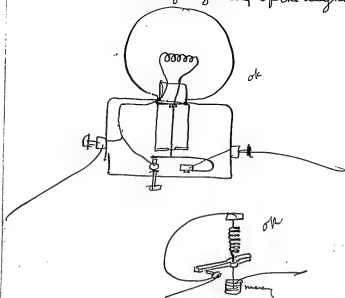
Menlo Park, N. J., Oct 8 1878

J. A. P.

Chas. Ketchum



Paint the globes with antimony etal will reduce the refrangibility of the light.





T. A. EDISON.

*Patent  
No 4*

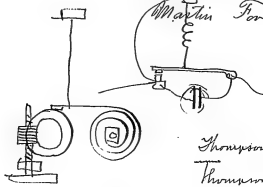
Menlo Park, N. J.,

*Oct 4*

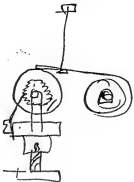
1878

*Edison  
Charcoal Battery*

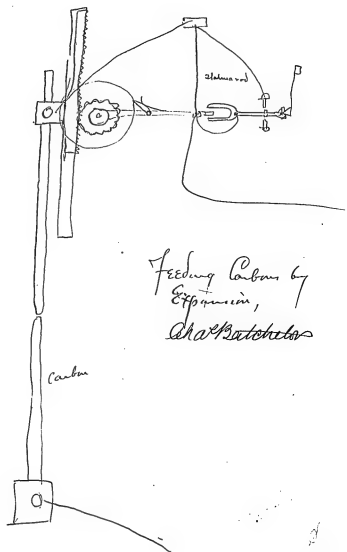
*Martin Force*



*Thompson  
Thompson*



Patent No. 5  
JAE  
Oct 12 1898



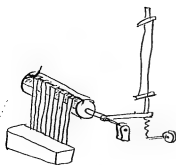
Feeding Carbon by  
Expansion,  
JAE Patent

T. A. EDISON.

Menlo Park, N. J., Oct 15 - 1878

Electric Light.

Caveat No 5



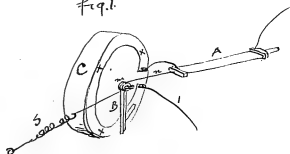
T. A. EDISON.

Electric Light

Menlo Park, N. J., Oct 15 - 1878

Caveat No 5

Fig. 1

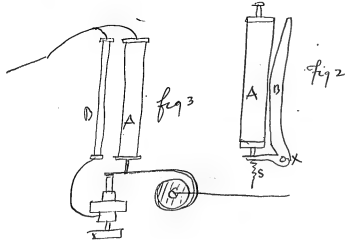
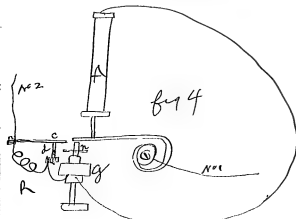


T. A. EDISON.

Electric Light

Menlo Park, N. J., Oct 15 1878

Caveat No 5 T. A. Edison

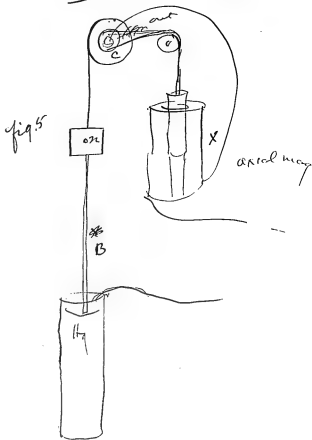


T. A. EDISON.

Menlo Park, N. J.,

Oct 15 1878

Caveat No 5 T. A. Edison



T. A. EDISON.

Patent No. 5 — Electric Light

Menlo Park, N. J., Oct 15 — 1878

T. A. Edison  
Char. Ratchet

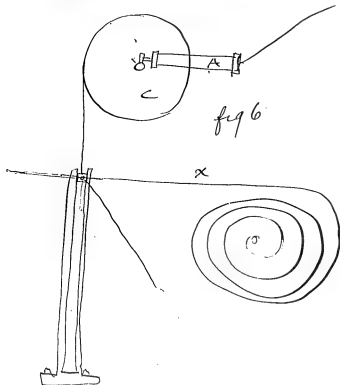


fig 6

T. A. EDISON.

Electric Light

Menlo Park, N. J., Oct 15 — 1878

Patent No. 9 —  
T. A. Edison  
Char. Ratchet

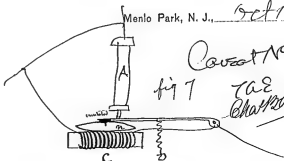
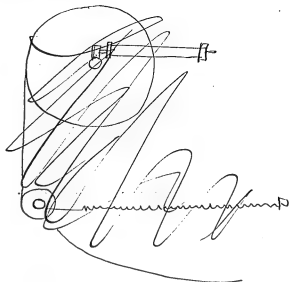


fig 7



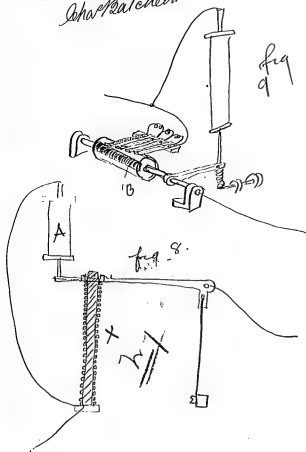
T. A. EDISON.

*T Edison Electric Light*

Menlo Park, N. J., Oct 13 1876

Patent No 5,

*Edison's*

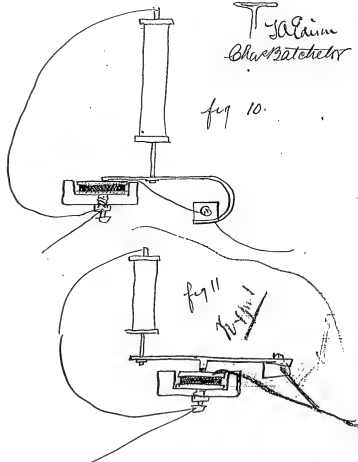


T. A. EDISON.

*Electric Light*

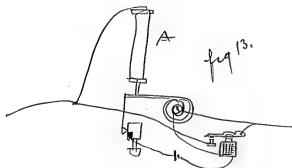
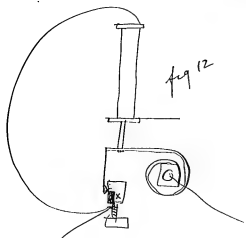
Menlo Park, N. J., Oct 15 1876

*T Edison*  
*Edison's*



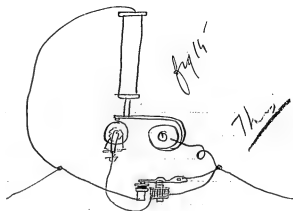
T. A. EDISON.

Menlo Park, N. J., Oct 15 1878  
 Electric Light Patent No 5, Medium  
 Charcoal tubes



T. A. EDISON.

Patent No 5 Menlo Park, N. J., Oct 15 1878  
 Electric Light J. A. Edison  
 Charcoal tubes



T. A. EDISON.

Electric Light

Menlo Park, N. J., Oct 15, 1878

Caveat Nos

J. A. Edison

Chas. Ketchum

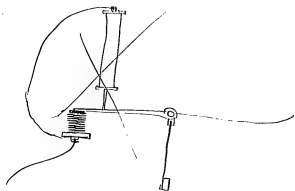
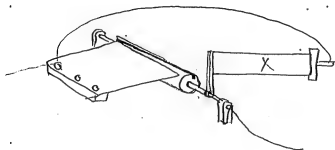


fig 16



T. A. EDISON.

Caveat Nos

Menlo Park, N. J.,

1878

Electric Light



Caveat Nos  
The  
Edison  
Lamp

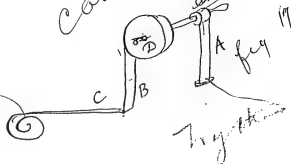


fig 17

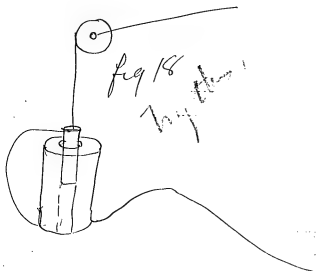


T. A. EDISON.

Menlo Park, N. J., Oct 15 1876

Patent No 5

Edison  
Char Patcher

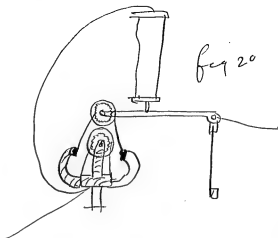
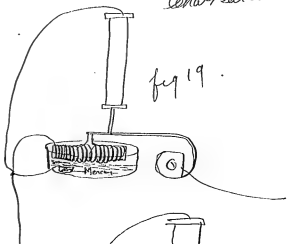


T. A. EDISON.

Menlo Park, N. J., Oct 15 1876

Patent No 5

Edison  
Char Patcher



T. A. EDISON.  
Caveat No 5-

Electric Light

Menlo Park, N. J., Oct 15 - 1878

J. A. Edison  
Char. Patcher

fig 21

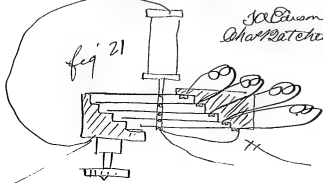
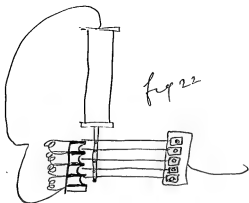


fig 22



T. A. EDISON.

J. A. Edison Electric Light

Menlo Park, N. J., Oct 15 - 1878

Caveat No 5-

Char. Patcher

fig 23

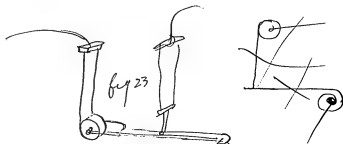
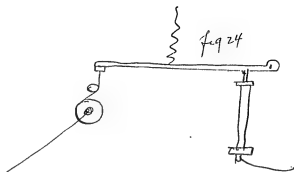


fig 24



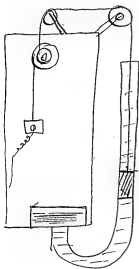
T. A. EDISON.

*Caveat No 5 -*

*TAE*

Menlo Park, N. J.,

*Oct 15 - 1878*



*fig 25 -*

T. A. EDISON.

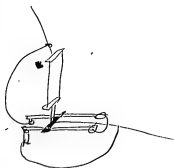
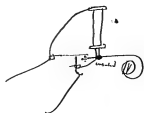
*Electric Light -*

*TAE*

Menlo Park, N. J.,

*Oct 6 1878*

*Caveat No 6*



T. A. EDISON.

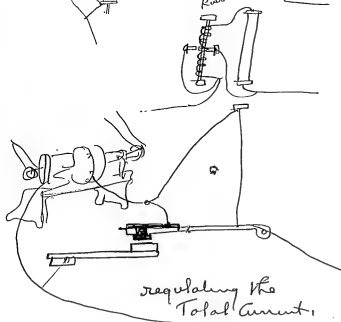
Menlo Park, N. J., Oct 16 1878

T. Edison

Caveat No. 6,

Caveat No. 6

Rubber

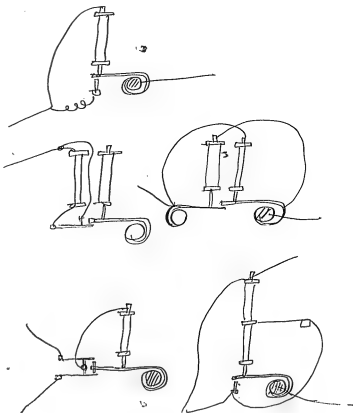


T. A. EDISON.

T. Edison

Menlo Park, N. J., Oct 16 1878

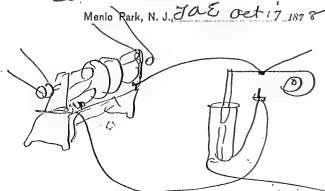
Caveat No. 6,



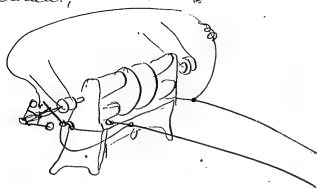
T. A. EDISON.

*Caveat no. 6.*

Menlo Park, N. J. *TAE Oct 17 1878*



*Regulating the total  
Current,*



*Regulating the speed of the  
magnets also to turn,*

*Electric Light Co. 18. 1878*

*Thos A Edison*

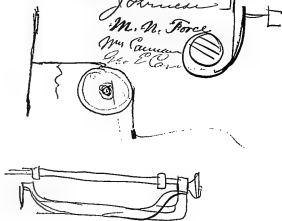
*Charles H. H. H. H.*

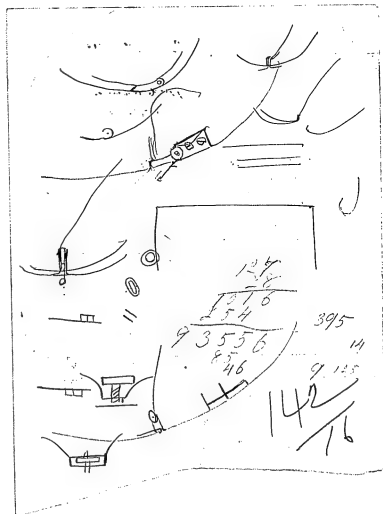
*J. H. H. H.*

*M. N. Force*

*Wm. H. H. H.*

*Edison & Co.*





T. A. EDISON,  
Menlo Park, N. J.

Page 16-17  
book dated Newark  
July 28 1871

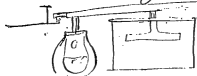
Maxim "Thermal" interference

T. A. EDISON.

Menlo Park, N. J., Oct 21. 1878 187

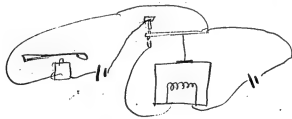
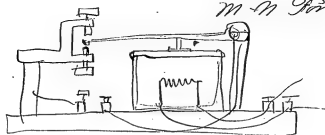
Thermal Relay —

Sharp Detector



Max J. Edison  
Patented P. 1878  
J. A. Edison

Edison & Co.  
M. M. Force



T. A. EDISON.

Menlo Park, N. J.,

Oct 23, 1878

Wrensi

Arrange a piece of sheet  
platina as thin as can be rolled,  
in this glass bulb. and fix  
bindpost with holes for largest  
wires on top and bottom  
it must be perfectly air tight  
same as at present

Chas B Atchelor

T. A. EDISON.

Menlo Park, N. J.,

Oct 23, 1878

W Edison

Wrensi

Make another like  
this statel but with a platina  
 $\frac{1}{4}$  inch wide and same thickness  
as  $\frac{1}{4}$  flat, and coiled up with  
edges butting so  
but not lapping  
this must test same  
as  $\frac{1}{4}$  sheet



Pateteln  
Johnesi



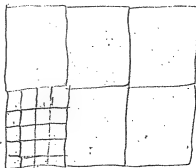


Nov 2 1878  
Calculation. 7a Edison

00

0

Jobalkoff	66 burners
Edison	5 "
Jobalkoff	$\frac{1}{40}$ of burner
Edison	$\frac{1}{6}$ "



Table

100

120, times the quantity.

$$\begin{array}{r} 14 \overline{) 1000.66} \\ \underline{90} \phantom{00} \\ 100 \phantom{00} \\ \underline{90} \phantom{00} \\ 100 \phantom{00} \end{array}$$

$$\frac{66}{1000}$$

$$\begin{array}{r} 66 \div \\ 15 \div \\ \hline 330 \\ 66 \\ \hline 990 \end{array}$$

Edison 8 cents 10 hours

Jobalkoff 32 Cents 10 hours,

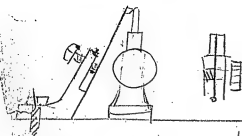
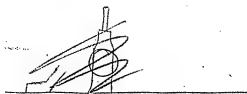
(12) Expense: Edison, 24 burners, 32 cents 10 hours  
 Jobalkoff 66 " 32 Cents 10 hours.  
 owing to greater quantity of Edison & number of  
 point getting round law of square, say 35 Edison  
 equal 1 Jobalkoff of 66 gas jets.

Make an Instrument to

Nov 9<sup>th</sup> 1895

Chas Patchen

a stand for a piece of carbon  
1/6 thick and 5 springs  
round all connect  
~~to~~ to a bind post of  
its own the carbon to  
a bind post also



||  
Patchen

Patchen  
J. H. M. C. C. C.  
M. A. Free

Thomas A. Edison  
Menlo Park N.J.

Nov 15 - 76

# Electric Light

Copied

Nov 15 1876

Elect. Light

Law -

Nov 15 1876

With a given wire having 1 ohm resistance + certain length brought to a given degree temp. by given battery. It will when coiled in such a manner that but one quarter of its surface radiates its temperature will be increased 4 times or -  $\frac{1}{4}$  battery will bring it to temperature of straight wire. Or same battery ~~with 4 times~~ <sup>inserting four wires</sup> in series will bring it to the same temp. as straight wire.

Total

resistance is 4 times

This was actually determined by trial

The amount of heat lost by a body is in proportion to the radiating surface of that body. If one square inch of platinum be heated to 100 deg it will ~~lose it~~ fall to say zero in one second whereas if it was at 200 deg it would require 2 seconds.

Hence in the case of non-descant conductors if the radiating surface be 12 inches and the temperature on each inch be 100 or 1200 for all, if it is so coiled or arranged that there is but  $\frac{1}{4}$  or 3 inches of radiating surface then the temperature on each inch will be 400. & if reduced to  $\frac{3}{4}$  of an inch it will have on that  $\frac{3}{4}$  1600 deg <sup>total</sup> takes notwithstanding the original amount was but 12 because the radiation has been reduced

to  $\frac{3}{4}$  or 75 units ~~hence~~ since the effect of the lessening of the radiation is to raise the temperature of each remaining inch not radiating to 125 deg =

If the radiating surface was reduced to  $\frac{3}{32}$  of an inch the temperature would reach 6400 deg fahr

~~of course~~ to carry out to the best advantage this law in regard to plasma etc then with a given length of wire to quadruple the heat ~~and~~ we must lessen the radiating surface to  $\frac{1}{4}$  & to do this in a spiral  $\frac{3}{4}$  must be within the spiral &  $\frac{1}{4}$  outside for radiating = hence a square wire or other means such as a spiral within a spiral must be used.

These results account for the enormous temperature of the

4

Electric arc with one horse power  
 as for instance if 1 hp will  
 heat a ~~12 inches~~ of wire to 7000 deg  
 fahr. & this concentrated to have  
 $\frac{1}{4}$  of the radiating surface it  
 would reach a temperature of 4000  
 deg or sufficient to melt it but  
 supposing it infusible the further  
 concentration to  $\frac{1}{8}$  its surface ~~or  $\frac{1}{4}$  of it~~  
 it would reach a temperature of 16000  
 & to  $\frac{1}{32}$  its surface which would be about  
 the radiating surface of the Electric  
 arc it would reach 64000 deg fahr.  
 of course when light it radiated in  
 great quantities & not quite these temperatures  
 would be reached. -

~~from the~~

Another Curious Law is this

~~the~~ If it will require a greater initial battery to bring an iron wire of the same size and resistance to a given temperature <sup>305</sup> than it will a platinum wire, in proportion to their specific heats, and in the case of Carbon if a pen of Carbon 3 inches long  $\frac{1}{8}$  diameter with a resistance of 1 ohm; it will require ~~for~~ a greater battery power to bring it to a given temperature than it would a cylinder of thin plasma foil of the same length diameter & resistance because the specific heat of Carbon is many times greater, besides if I am not mistaken the radiation of a roughened body for heat is greater than a polished one ~~or~~ like platinum which may be polished,

100 inches  
25 inches



A gas jet equals a Gobelkoff  
Candle when concentrated in  
the same space

A gas jet has - 10 square inches <sup>radiating surface</sup> ~~as a gas jet~~ 15 candle p.  
if reduced to ~~2 1/2~~ 62 ~~240~~ 960

The latter radiating surface is about equal to  
the radiating surface of the arc of a Gobelkoff  
Candle; hence an ordinary gas jet if concentrated  
to the size of the Gobelkoff arc would give  
the same light, or in other words the  
same power which gives a gas jet  
of 15 Candle power will give 1000 by  
concentration,

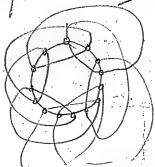
If the radiating power or time of a substance  
is decreased the gain in light is directly  
to the decrease for instance if 3 coils  
with platinum coils obtain 4 burners  
of 15 C.P. each per h power then by  
reducing the <sup>radiating</sup> power 50 per cent I would  
obtain 8 burners



Wire  
all together

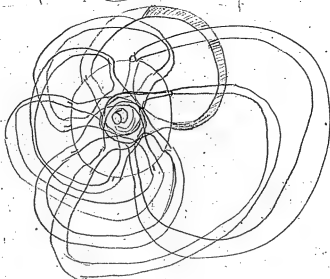


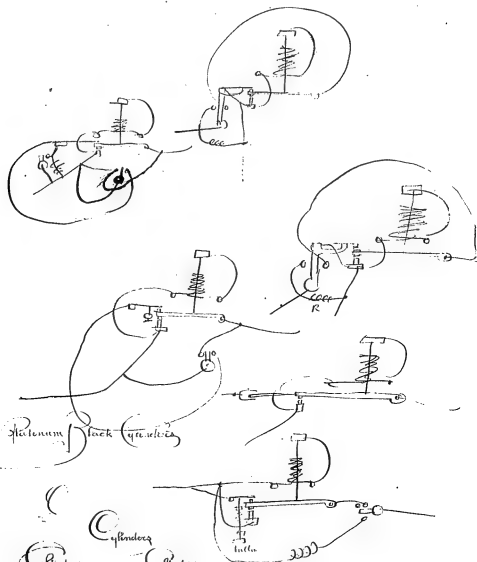
Dec. 1898  
J. E. Dunn



paper insulation

Cont.





Platinum Block (quartz)

Cylinders

1/2

Cylinders

Cylinders

100.

100.

500

Cylinders

Platinum Cylinders

10. 50. 1000 50000

3

Alfred Godillot desires that during the time asked for the justification of title, the parties in question being submitted to the arbitration of a person of his own who will notice the facts on formalities relative to these patents have been complied with, if they are not anticipated by others, and ~~to~~ <sup>so</sup> word if there is no delay <sup>to the</sup> putting of them in exploitation in France ~~proper~~.  
 The parties have delayed this day the conclusion of agreement next a letter of proof of consolidation only for to be regular.  
 as after the justification of the titles of powers of Barclay & Perkins - the actors of the Speech Engineer, advice demanded by Godillot in the agreement of Barclay & Perkins.

Article 1<sup>st</sup>

- On Barclay & Perkins on the one part, Godillot on the other part agree that M. Armingaud Jr. engineer living in Paris 19 Boulevard Strasbourg will be asked to give his advice on the patents a question in that which concerns the formalities relative to their value in regard to all other similar patents having been taken & the possibility of putting these patents of Gray Edison & Barclay with the certainty of right in as doing these titles clear & advice got being favorable the delay of a month being the only delay the company will be formed legally & clause stipulations & condition as after

1878. Ink for the Blind (NS-78-006)

Shallows - 70%  
Yellow - 10%

Tenness oil

Warrington

Simon

Peppermint

Tussock

Tanger

Pennycornal

Orange

Orange

Orange

Orange

Orange

Orange

Orange

Orange

Orange (5% pink)

Anise

White thyme

Orange

Thyme

Carri

Caesia

Laurel

REES

Quicks

Quicks

Quicks

N-G

Fair

N-G

N-G

N-G

N-G

N-G

N-G

N-G

N-G

N-G

N-G

N-G

N-G

N-G

N-G

N-G

N-G

N-G

N-G

N-G

N-G

Ink for the Blind  
Sep 2 1878

Coconut Oil 25%

Grape (Sugar) "

Deer (Sugar) "

Boiled Linseed Oil "

Coch Gody Varnish Fair

Terpentine 75%

Asphaltum "

Salid Oil Fair

Balsam Fir 75%

Tallow "

Venice Turpentine "

Glycerine "

Chloroform Fair

Sulphurous Acid 75%

Sassafras "

Copaiba Balsam "

Oil Cade "

Oil Apricot "

Hypocyparato Lignum "

Iodide of Zinc Fair

Lactate of Zinc 75%

Sulphate of Strychnine "

Lactate phosphate of Strychnine "

Bicarbonate of Potash "

Acetate of Strychnine "

Mono Chloro Acetic Acid "

Phosphoric Acid "

Phosphate of Magnesia "

Guin Arabic	"	Amygdaline	"
Bicarbonate of Soda	"	Salts of Iron	"
Bromide of Potass	"	Arsenate of Soda	"
Arsenate of Soda	"	Sulphate Quinine	"
Ferrid Cyрид of Potass	"	Valerianate of Zinc	"
Iodide Quinine	"	Chloride of Lithium	"
Acetate of Alumina	"	Sulphate Cobalt	"
Cyрид of Mercury	"	Protochloride of Tin	"
Tartrate of Iron	"	Lupulus	"
Sulphate Indigo	"	Iodide of Calcium	"
Carbonate Lithia	"	Sulphate of Antimony	"
Caffeine	"	Acetate of Strontia	"
Valerianate of Manganese	"	Sulph. Carbonate of Soda	"
Acetate of Silver	"	Acetate of Iron	"
Iodide Cadmium	"	Sulphate Alumina	"
Acetate of Morphine	"	Pernanganate Potash	"
Manganate of Soda	"	Manganate	"
Tartrate of Manganese	"	Acetate Nickel	"
Alum	"	Sulpho. Vinat. Sodium	"
Hypo-sulphate of Manganese	"	Tartaric Acid	"
Chloride Nickel	"	Pesque Chloride Iron	"
Tartrate of Quinine	"	Tragacanth	"
Proto Acetate of Copper	"	Acetate Ammonia	"
Carmine	"	" Strontia	"
		Lactate of Iron	"
		Chloride Strontia	"
		" Ammonia	"

Uranium & Sodium	X.P.	Terrucyanide Potash	n.p.
Sulphate of Bismuth	"	Hypuric Acid	"
Uvic Acid	"	Arsenate quinine	"
Chinic Acid	"	Citrate Potash	"
Nitrate Uranium	"	Camphoric Acid	"
Chloride "	"	Pyrogallie "	"
Phosphate of Soda	"	Nitrate of Zinc	"
Caprine	"	Lactate "	"
Iodide Ammonia	"	Phosphate of Calcium	"
Caprine	"	Oxalate of Soda	"
Volcanic Potash	"	Acetate Baryta	"
Carbonate of Magnesia	"	Citrate Ammonia	"
Alum	"	Tartrate of Potash	"
Sulphate Copper	"	Sulphate Magnesia	"
Citrate of quinine	"	Molybdaenic Acid	"
Formate of Copper	"	Formate of soda	"
Nitrate of Strontia	"	Sulphate of Cadmium	"
Sulphate Cadmium	"	Tungstate Soda	"
Citric Acid	"	Bismide Arrowroot	"
Chlorate Soda	"	Bromide Cadmium	"
Bichromate Potash	"	Chloride Potassa	"
Sulphate Zinc	"	Phosphate Ammonia	"
Tartrate of Soda	"	Citrate of Potash	"
Phosphate Lime	"	Nitrate Magnesia	"
Nitrate Magnesia	"	Permanganate Iron	Tan
Chemic Acid	"	Tri Chromate Ammonia	n.p.
		Stannate of Soda	"
		Sulphate of Baryum	"



Chloride Alumina	n.e.	Bichloride Mercury	n.e.
Caustic Baryta	"	Benzoate Ammonia	"
Sulphate Lithia	"	Carbazotat	"
Hypophosphate Quinine	"	Picrotoxin	"
Sulphate Caffein	"	Chloride Baryum	"
Sulphate Ammonia	"	Sulpho Carb - off line	"
Boric Acid	"	Acetate Urimum Potash	"
Hydriate Ammonia	"	Chloride of Lead	"
Glycerotricine	"	Phosphate Magnesia	"
Oxalate Ammonia	"	Acetate Lime	"
Arsenious Acid	"	" Cobalt	"
Iodide of Lime	"	Acetate Magnesia	"
Caustic Potash	"	Chromate Potash	"
Fluoride of Sodium	"	permanganate Sodium	"
Chloride Barium	"	Borate of Copper	"
Baptisium	"	Bisulphate Soda	"
Picrate Ammonia	"	tartrate Manganese	"
Benzoate of Soda	"	Acetate Zinc	"
Salicine	"	Ammonia Citrate Zinc	"
Pyrophosphate of Sodium	"	Oxalate Potash	"
Iodide Potash	"	Citrate Magnesia	"
Tartrate of Iron	"	Cyanide Mercury	"
		Hydrate Alumina	"
		Phosphate Manganese	"
		Anthracate of Potash	"
		Protochloride Iron	"
		Iodide Barium	"
		Uim Guacum	"
		Chloride Zinc	"

Asparagin n e  
 Glyco coll  
 Mannite "  
 Nitrate Lime "  
 Sulphate Barium "  
 Iodide Cadmium "  
 Chloral Hydrate "  
 Lactic Acid "  
 Fluorideine "  
 Caustic Soda & Gum Sandarac "  
 " " Balsam Capivi "  
 " " Balsam Canada "  
 Glycerine "  
 Bitartrate of Potash "  
 Caustic Potash & Shellac "  
 " " Sandarac "  
 " " Benzoin "  
 " " Gamboge "  
 " Venice Turp "  
 Gum Gamboge "  
 " Guaiacum "  
 Micro Cosmic Salt "  
 Perchlorate Potash "  
 Zinnic Oxide "  
 Sheet Gelatine "  
 Thick Card Board

paper saturated with  
 the above and then  
 written on with  
 Arsenic Acid

Chas P. Batcher  
 Wm. Larnan

Chas Batcher

1378. Phonograph (NS-78-007)

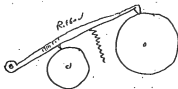
Facsimiles prepared for use as exhibits in American Graphophone  
Company v. Edison Phonograph Works follow all other notes and drawings.

Photograph

July 2, 1878

70 Edin

atchito  
Chinese

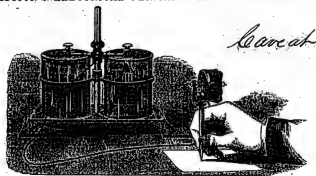


Photograph

for enlarging the record on a second  
Cylinder by leverage  
an Elastic band on 1st cylinder and  
rotated slow to give full time  
to act

In registration perhaps a wheel shaped part  
would be sent thru U and out thru U the sheet  
could be out connected with an offsetting  
reproduction =

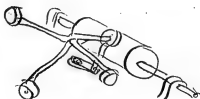
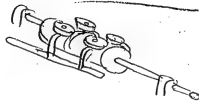
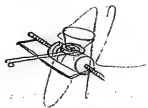
# EDISON'S ELECTRICAL PEN AND DUPLICATING PRESS.



CHAS. BAYCHELOR, General Agent for Foreign Countries.  
P. O. Box 9807.

New York \_\_\_\_\_ 187

Feb 3 1878

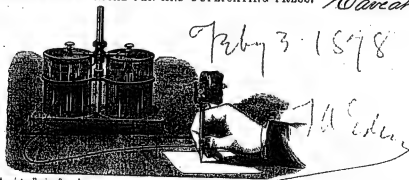


Double record right & left

# EDISON'S ELECTRICAL PEN AND DUPLICATING PRESS.

*Harvard*

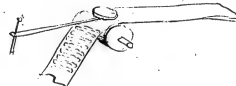
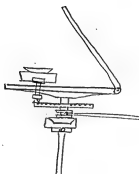
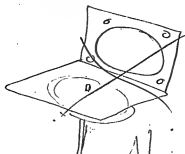
*Feb 3 1878*

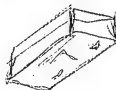


CHAS. BATHURST, General Agent for Foreign Countries.  
P. O. Box 6807.

*New York* ————— *187*

*rem-fol*



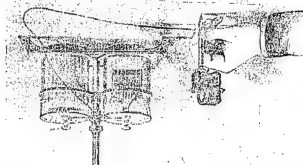


Copy of Plan  
Character

1894

181

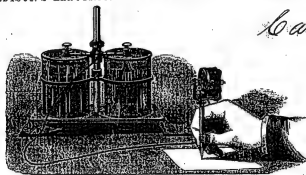
TO THE PUBLIC BY THE INVENTOR



EDISON'S ELECTRIC LAMP AND IMPROVED PRESS

1894  
12 m

# EDISON'S ELECTRICAL PEN AND DUPLICATING PRESS.

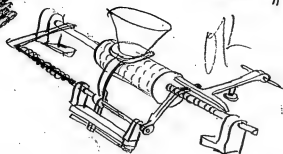
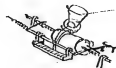
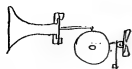


*Carcat*

CHAS. BATHURST, General Agent for Foreign Countries.  
P. O. Box 2807.

*New York* \_\_\_\_\_ 187

*July 31 1878*  
*Yardley*



*OK*





General

Feb 3, 1878  
Thos. H. M.

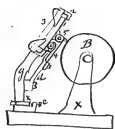


Fig. 1.

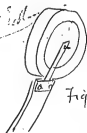


Fig. 7



Fig. 8

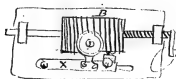


Fig. 2.

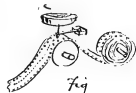


Fig. 9

OK



Fig. 6.



Fig. 4.



Fig. 5.

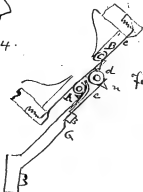


Fig. 3.



Fig. 13

OK



Fig. 14

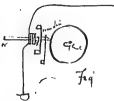


Fig. 15

OK



Fig. 16

OK

3/3

*banat*

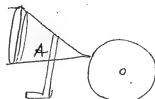
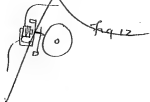
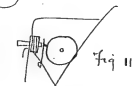
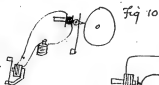
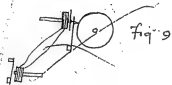


Fig 13



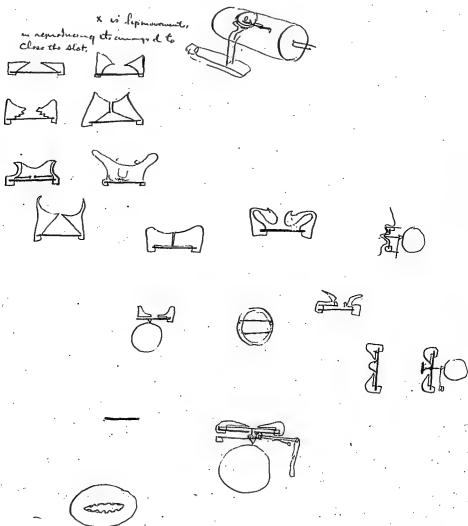
July 3 1878

W. S. D. W.

Photograph -

Feb 8. 1878.  
Tadbury

x is separator,  
in reproducing its drawings it to  
close the slot.



Carroll

July 3 1876

Thurs



X

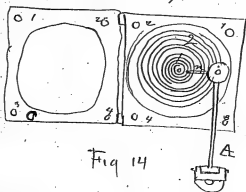


Fig 14

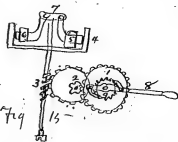


Fig 15

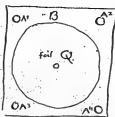


Fig 16



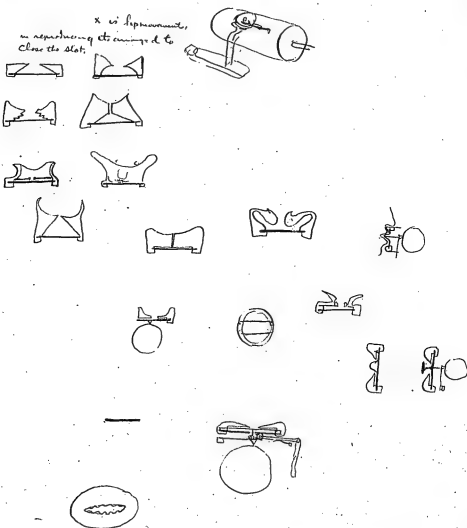
Fig 17



Phonograph -

Feb 8. 1878.  
Tadbury

x is separated;  
in reproducing it arranged to  
close the slot;

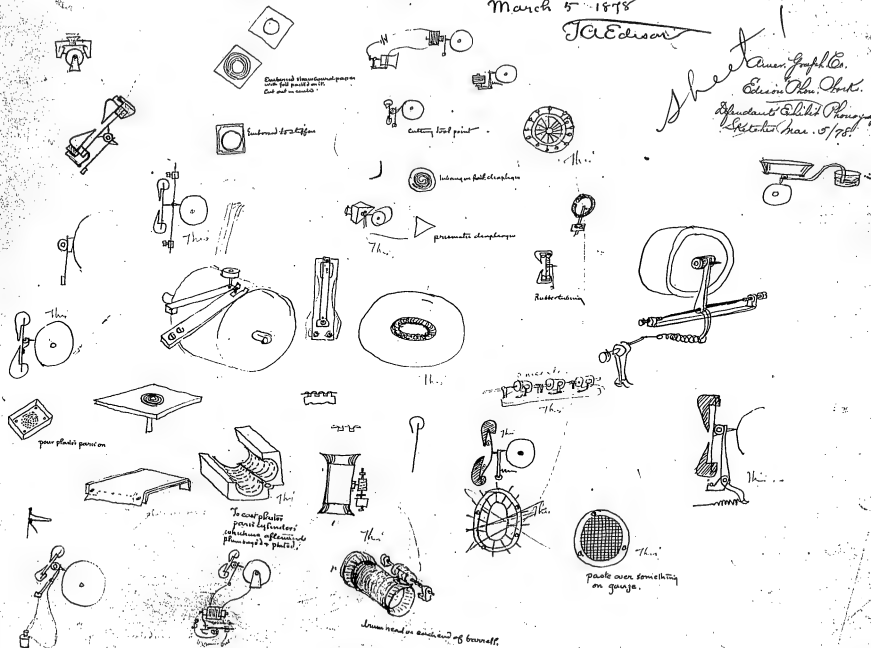


Phonograph Devices for ~~new~~ Cameo No. 2. Photo -

March 5 1878

J A Edison

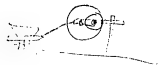
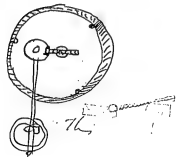
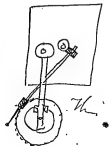
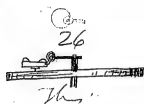
Sheet 1  
Ames Graph Co.  
Edison Phon. Work.  
Affidavit Exhibit No. 999  
Kitchin Mar. 5/95.



Phonograph Patent No. 2. Sheet 2.

March 28 1878

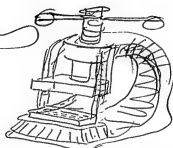
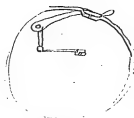
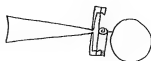
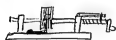
T. Edison



To be returned,

May 10 1898

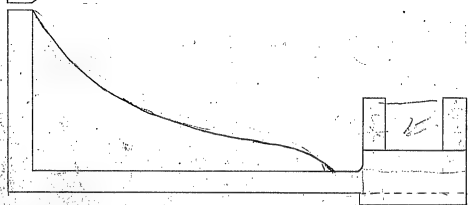
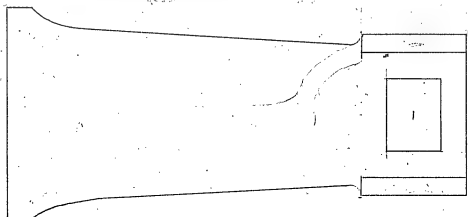
# Caveat Phonograph



Stamping Press



May 13th 1858 J. H. H.



T. A. EDISON,

~~Menlo Park, N. J.~~  
Menlo Park, N. J.

W. Kuesi—

Please make me  
diaphragms for this and  
mark which way they go  
on of the following things

- X 1. Ferotype plate
- X 2. Drawing paper
- X 3. Cork. — thin up stairs
- X 4. Hard Rubber
- X 5. Hitting paper
- X 6. Soft rubber 2
- X 7. Sheet brass
- X 8. Copper (thinner)
- X 9. Patent leather
- X 10. Paraffin paper
- X 11. 2 lb paper from roll up stairs  
so that I can soak them  
in different things.
- X 12. One of each thickness of turpentine  
Batches

X1 of paper dipped in shellac

X1 " wood

X1 " painted paper

X1 " Bladder

X1 " leather

X1 " Linen "

X1 German Silver

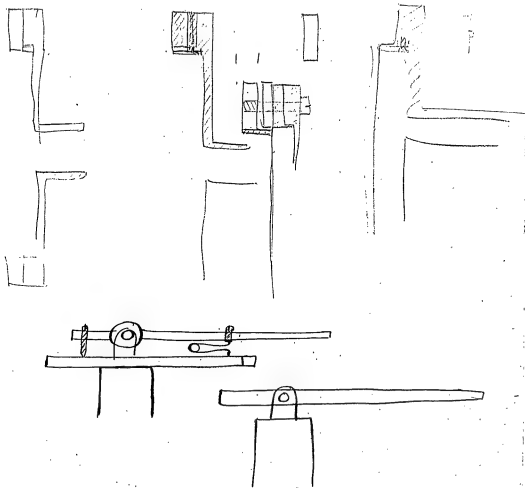
X1 Steel

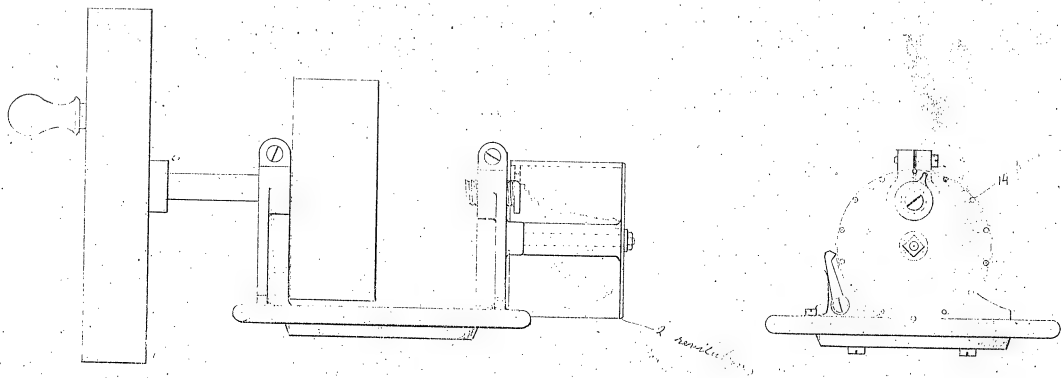
Monograph

July 10<sup>th</sup> 1898

No. 12a. Sketch

Diaphragm must be sketched





to be used for Tapping & also to remove at 1000 lbs.

Design a trip to pull on

Electric  
Tapping  
Cable

A Edison  
Electric  
Co. of  
N.Y.

to be carried by

Stop Motion

tailpiece clock  
Feb 20 1898

Patented



Glass  
Aluminum  
1890: 7 8 11 2 50  
1891: 7 8 11 2 50  
1892: 7 8 11 2 50  
1893: 7 8 11 2 50

Al. 3-56  
1-70

Union Pacific  
Carr. Co.  
Chicago  
Ill.  
Feb 20 1898



17  
186  
11 17  
20 22

Monograph

Feb 22 1898

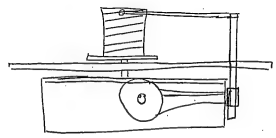
Spending statement for  
Clocks

Charles H. Hahn

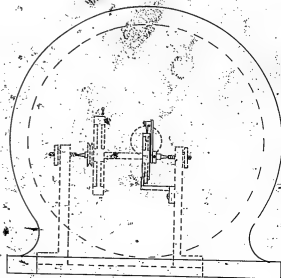
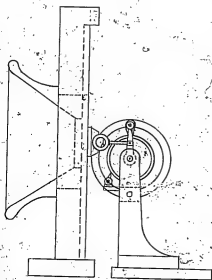
A. A. Hahn  
1000  
M. M. Jones

Drum 4 diam

Union Pacific  
Carr. Co.  
Chicago  
Ill.  
Feb 20 1898



1878. Phonometer (NS-78-008)



Sutton's Phonometer

May 13 1878

Chas. Batchelor.

Wm. H. H. H.

Wm. H. H. H.

Note: Drawing of the phonometer  
is not a model.

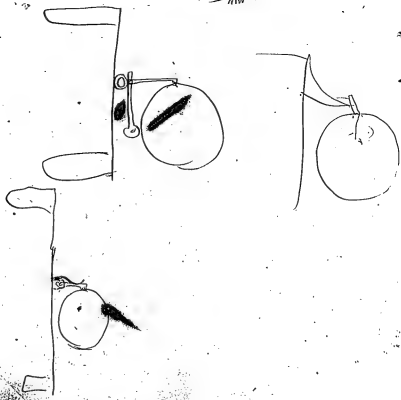


Edison

Thomson

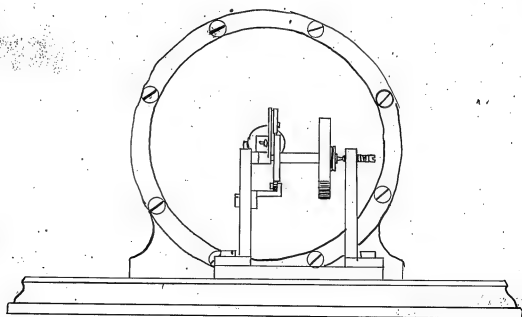
Chas. Satchel  
pursuant to Sept 1<sup>st</sup> 1898

Johnnie  
M. M. Ford

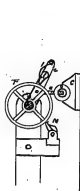
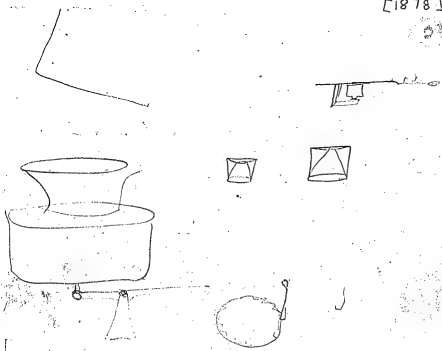




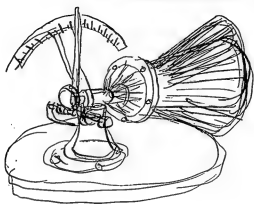
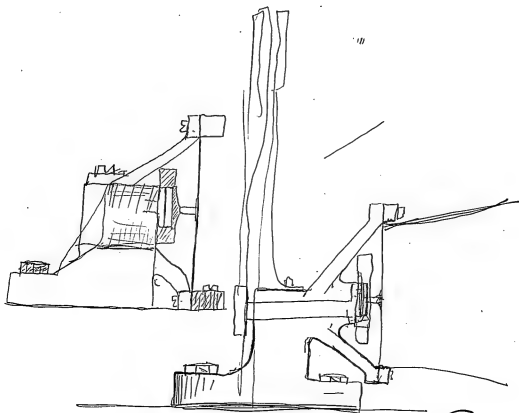
[1878]



[1878]



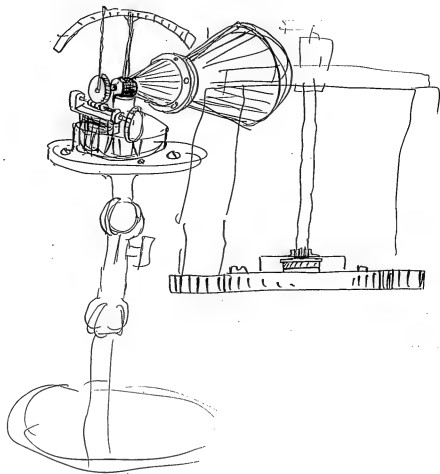
1878. Tasimeter (NS-78-009)



Custom Electro-Thermometers

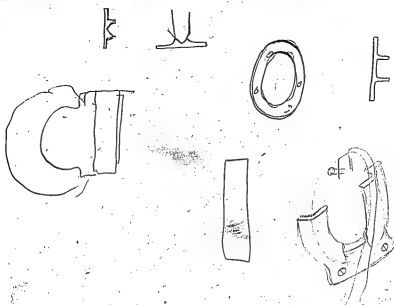
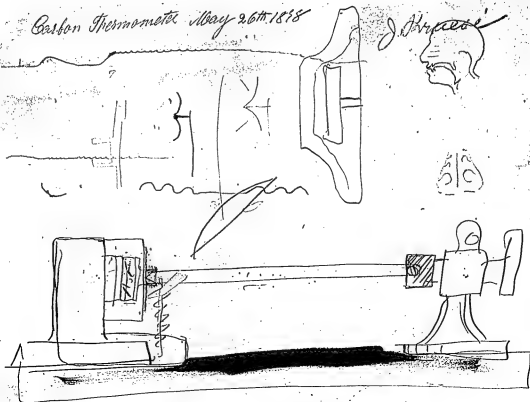
May 16 1876

May 15/1898  
Wednesday  
Calcutta to Thimaru

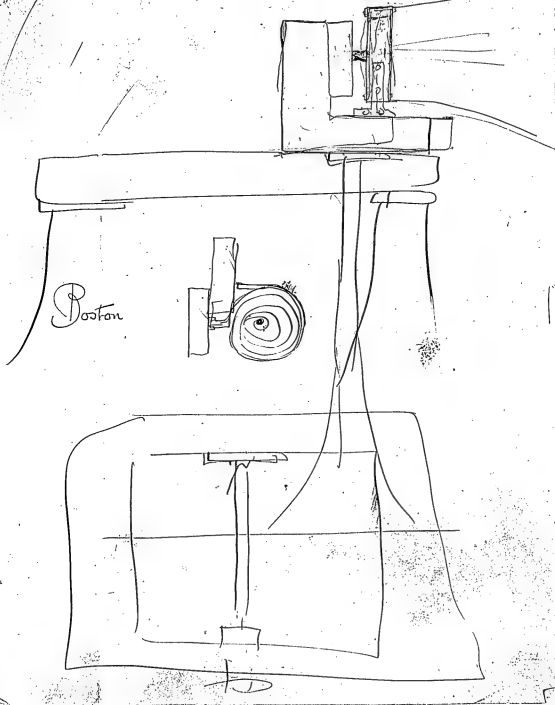


Carbon Thermometer May 26th 1878

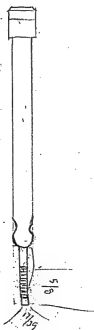
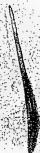
J. H. P. 1878



*J. Krueger*





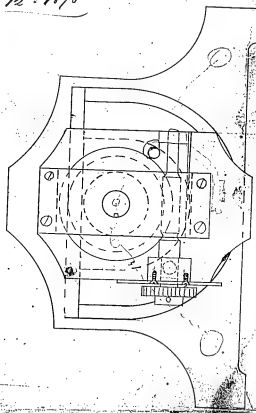
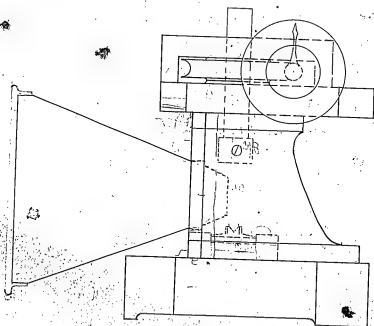


*Edison's Micro-Tasimeter*

*Mont. Park, N.Y. June 12<sup>th</sup> 1878*

*Charles F. Smith*

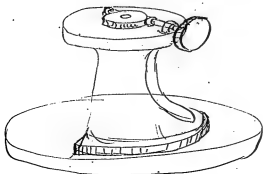
*J. H. P. Smith*



Heat Measure  
Micro-Tesameter

June 12 #1841

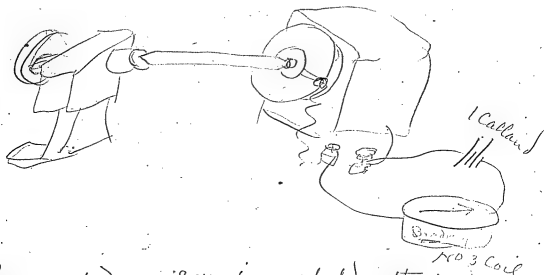
Chapatchelov



June 23 1878

T A Edison

Some experiments with vulcanized hard rubber in  
the tasimeter



Paper soaked in oil mercuric held within  
1/2 of inch from strip: causes  $q$  to deflect from  
45 to 47. (note: Oil mercuric softens hard rubber in 3 weeks)

Cresote, do from 45 to 46 1/2 -

Carbolic acid, no effect.

Benzene, Contracts owing to cold produced by evaporation

Cyanide Potassium expands it from 45 to 47

Chloralhydrate on end of brass rod makes it go up  
1/2 degree

Turnip Co to Soda end glassed 1 deg - bend it after  
being exposed to air 20 minutes so it must  
be at same temperature

# Pieces for Instruments

- 3 Orlon
- 3 Cotton
- 3 Copper
- ~~3 Silver~~
- 3 Iron
- 3 Nickel
- 3 Steel
- 3 Silver
- 3 Zinc
- 3 Tin
- 8 rubber  $\frac{1}{32}$  &  $\frac{1}{16}$  thick
- 8  $\frac{1}{16}$   $\frac{3}{16}$   $\frac{1}{8}$  wide

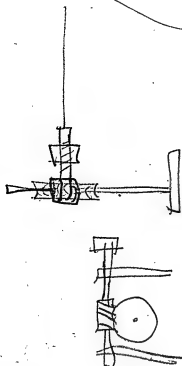
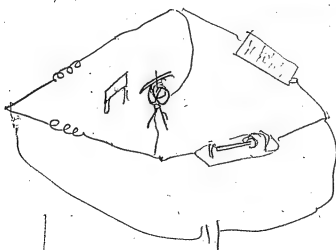
July 10th 1900  
J. H. H. H.  
O. H. H. H.

- 3 Aluminium
- 3 Cadmium
- 6 Copper
- 6 German Silver
- 6 Iron
- 3 Nickel
- 3 Lead
- 3 Platinum
- 3 Silver
- 6 Zinc
- 2 Tin

- $\frac{1}{16}$   $\frac{1}{8}$   $\frac{1}{4}$   $\frac{1}{2}$   $\frac{3}{4}$   $1$   $1\frac{1}{2}$   $2$   $3$   $4$   $5$   $6$   $7$   $8$   $9$   $10$   $11$   $12$   $13$   $14$   $15$   $16$   $17$   $18$   $19$   $20$   $21$   $22$   $23$   $24$   $25$   $26$   $27$   $28$   $29$   $30$   $31$   $32$   $33$   $34$   $35$   $36$   $37$   $38$   $39$   $40$   $41$   $42$   $43$   $44$   $45$   $46$   $47$   $48$   $49$   $50$   $51$   $52$   $53$   $54$   $55$   $56$   $57$   $58$   $59$   $60$   $61$   $62$   $63$   $64$   $65$   $66$   $67$   $68$   $69$   $70$   $71$   $72$   $73$   $74$   $75$   $76$   $77$   $78$   $79$   $80$   $81$   $82$   $83$   $84$   $85$   $86$   $87$   $88$   $89$   $90$   $91$   $92$   $93$   $94$   $95$   $96$   $97$   $98$   $99$   $100$

Transmitter  
July 1878

J. A. Edison  
Chas. B. Bate



300.

$\frac{1}{100}$

T. A. EDISON,

Menlo Park, N. J.,

1878

11  
John K. Keesi  
Make (4) four  
Micro Lasimeter.  
Chas. B. Bate

One was finished about 25th of June & given to Hoff.  
Jong  
One for Mr. Edison finished July 11th.  
One the same " 18th.

Monmouth Park, N. J.

187

Oct 3<sup>rd</sup> 1898

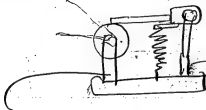
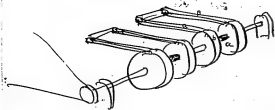
T.A.P.

Stockton Bluff

M. H. Rose Yosemite, Yosemite, Yosemite



J. H. Rose



OFFICE OF

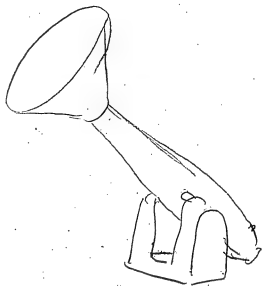
WM. L. ASH,

Judge of Probate and County Treasurer,

CARBON COUNTY, WYOMING TERRITORY.

Sanctus,

187



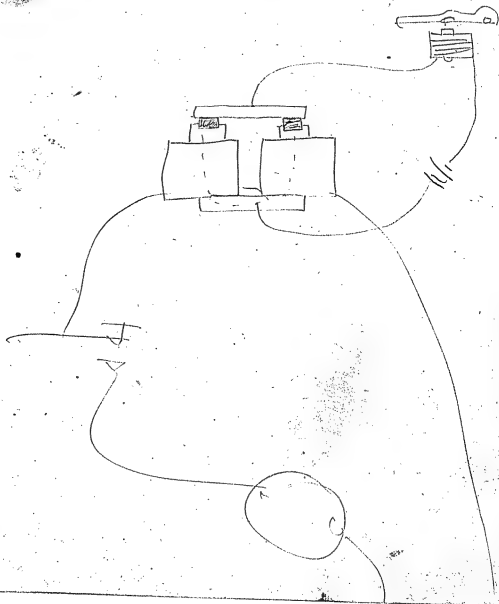
1378. Telegraph (NS-78-010)



Pressure Relay

Talder

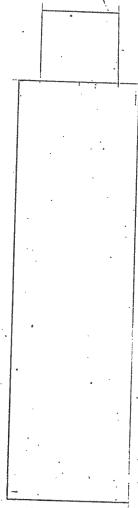
Chapman & Jones



Seasonable Sewing

Aug 29th 1888

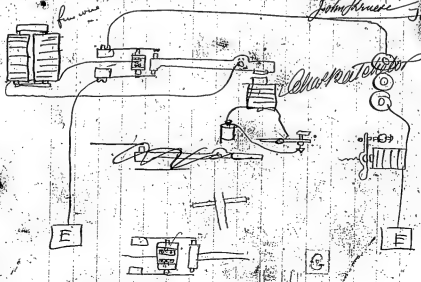
Thos  
Chas Patchell  
M-in Tr



187

Way Double x

Model Aug 31 1871  
John H. Moore Jan



September 1, 1878  
J. A. Edison

Personally appeared before me this 10 day of Sept 1878, the said Thos. A. Edison, Chas. H. Johnson, John Krout, and Martin P. Ford, and acknowledged the above to be their signatures.

Notary Public

55 North 4th Street

Philadelphia

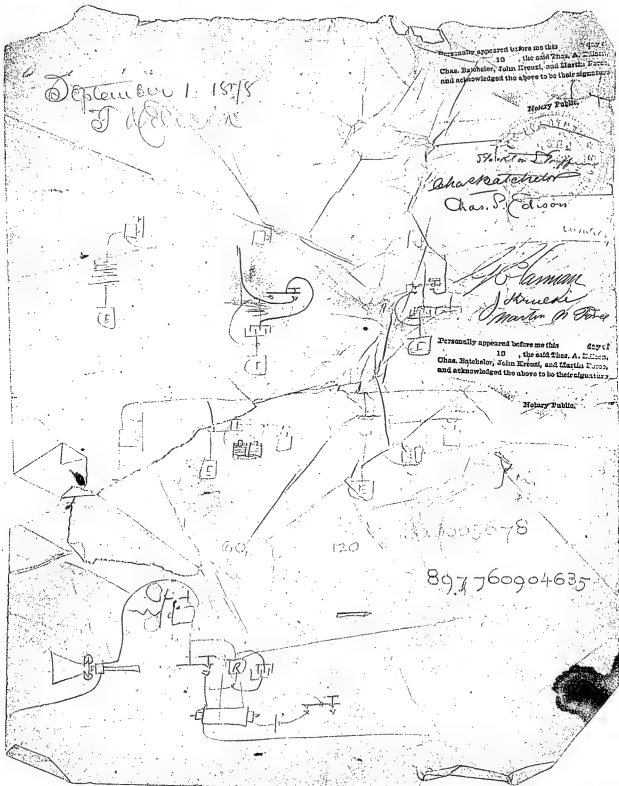
Chas. P. Edison

J. A. Edison  
Martin P. Ford

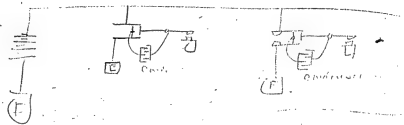
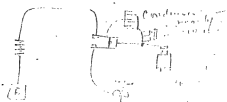
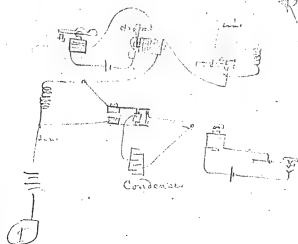
Personally appeared before me this 10 day of Sept 1878, the said Thos. A. Edison, Chas. H. Johnson, John Krout, and Martin P. Ford, and acknowledged the above to be their signatures.

Notary Public

897760904635



September 1, 1878.



Personally appeared before me this 19 day of September, 1878, the said Thos. A. Chas. Batchelor, John Krewel, and Martin Force, and acknowledged the above to be their signatures.

Notary Public.

Receiving information  
for the purpose of  
J. A. Edison

Chas. Batchelor  
Chas. P. Edison

J. A. Edison

J. Krewel  
Martin W. Force

Personally appeared before me this day of September, 1878, the said Thos. A. Edison, Chas. Batchelor, John Krewel, and Martin Force, and acknowledged the above to be their signatures.

Notary Public.

Evidence.

Sept 1 1879 J.A.S. & Co.

Chas. S. Edison

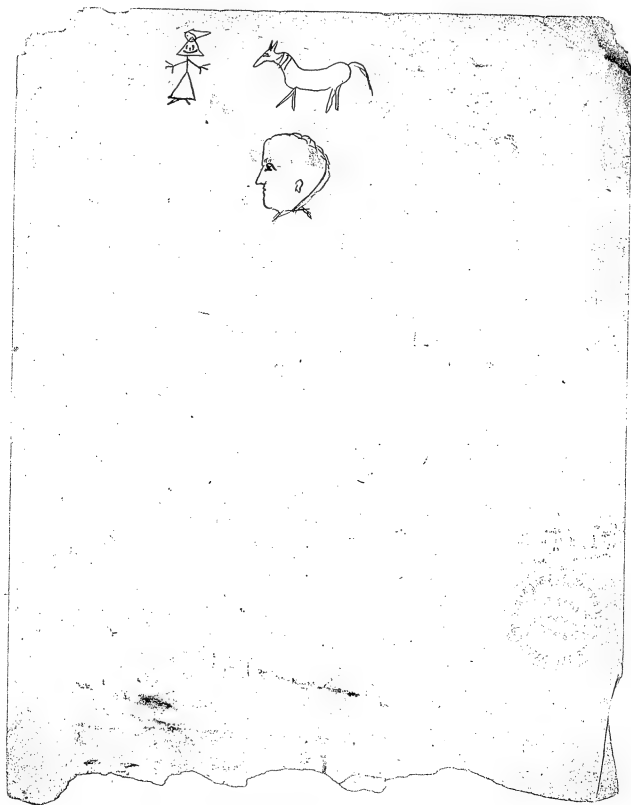
W.C.

J.E. Corman

J. H. Hines  
Martin Force

Personally appeared before me this day of  
1879 the said Chas. S. Edison,  
Chas. H. Hines, John H. Hines, and Martin Force  
and acknowledged the above to be their signatures.

Notary Public.



May 1891

*Charles F. Edwards*

Notary Public

$\frac{1}{2}$ , and the limit of the sequence is  $\frac{1}{2}$ .

the structure never with any.

<sup>9</sup> Mould is not a common term used in clay

Checked the machine once with the

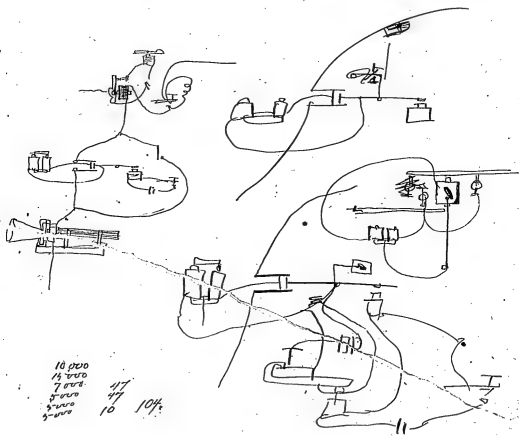
[illegible]

21.  $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$   $\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$   $\frac{1}{16} \times \frac{1}{16} = \frac{1}{256}$



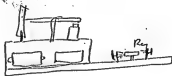
Sept 1918 Taldom way Dupuy

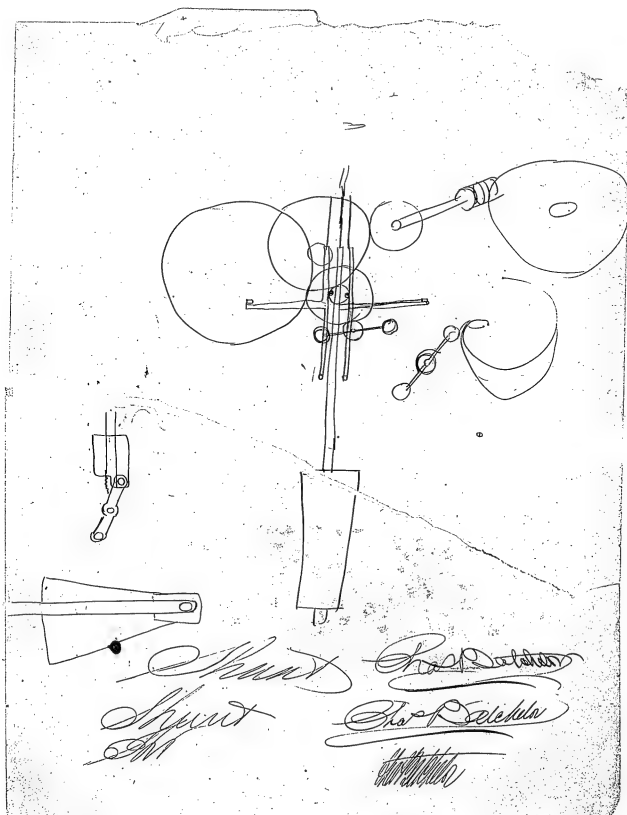
J. J. J. J.  
Charactetator



10 000  
15 000  
7 000  
5 000  
5 000  
10 10%

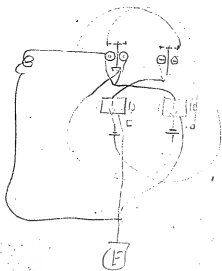
Portland Portland  
Portland Portland







Way Duplex  
Sept 3 1976  
Sundown



Way Station

Double Border

Sept 3 1898

100

75

1200

400



1400

100



$$\begin{array}{r}
 150 \\
 -150 \\
 \hline
 150 \\
 150 \\
 150 \\
 150 \\
 \hline
 600 \\
 226 \\
 \hline
 826
 \end{array}$$

9

Edison  
Tuning Fork Resonator

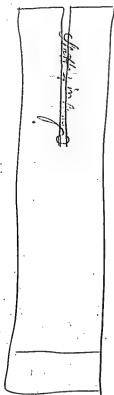
Sep 13<sup>th</sup> 1907

H. A. Edison  
Chas. Batchelder

J. Kinney

M-M Power

Mr Kinney will you make from pen wheel tubing  
a fork.



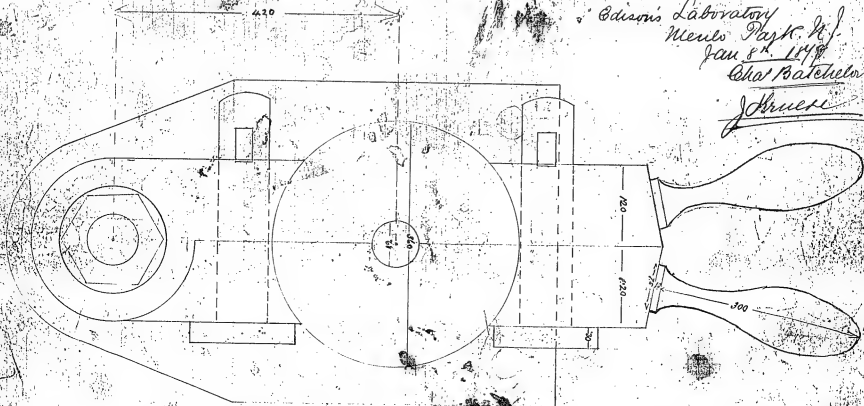
Length of tube about 18 in.  
Length of slot at first 4 in.  
plug up the hole at the end  
to hold water

1878. Telephone (NS-78-011)



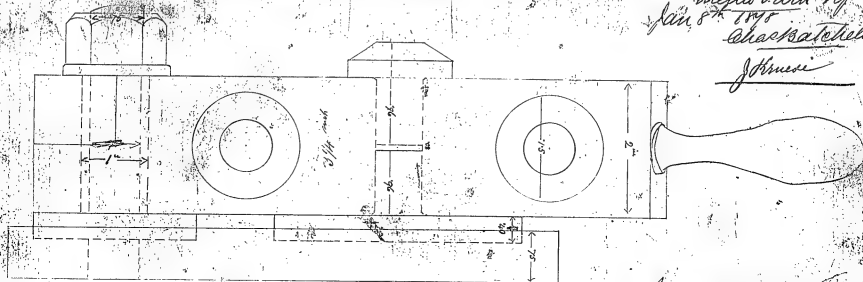
Moulds for Speaking telephone positions

Edison's Laboratory  
New York  
Jan 8<sup>th</sup> 1878  
Chas. Batchelor  
*Johnes*



Model for Speaking Telephone Compression.

Edison's Laboratory  
West Park N.Y.  
Jan 8<sup>th</sup> 1895  
Charles Ketchum  
Johnson

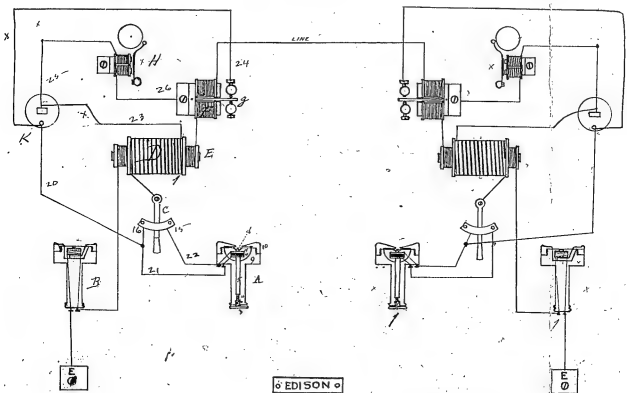


No. 1. completed Feb. 15, 1895  
No. 2. a. Original Feb. 18, 1895

Case No 157

Station No 1.

Station No 2



EDISON

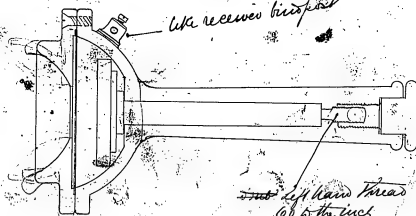
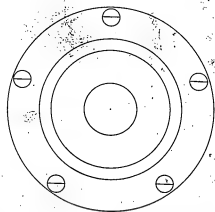
Patented Nov. 13, 1878 J. A. Edison

Patent Office Model for  
Edison's Speaking Telephone  
Serial No. 157  
Chas. Batchelor.

J. A. Edison  
Laplone  
Case 151.

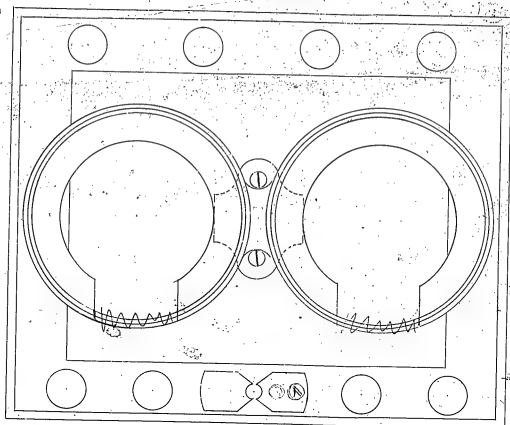
Recd Feb. 19, 1878,

Editor's  
Design for Cantenna Transmitter  
No 28.  
Sahawneh Station, Md. 22, 1948  
Hend. J. J. J.

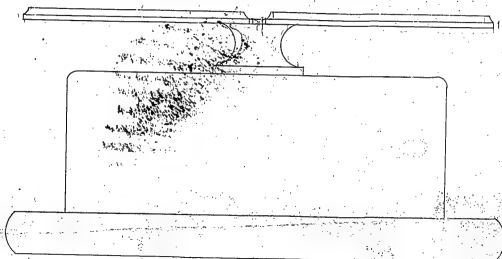


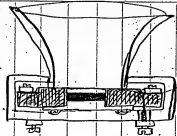
into left hand thread  
60 to the inch

J. K. K.



Bracket for telephone rest on oil bore  
 Edison's Speaking telephone  
 May 2<sup>d</sup> 1878  
 No 46  
 Chas Batchelor  
 Invented 1878 John Krueger



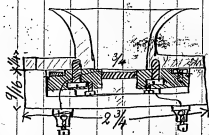


thin sheet rubber stretched across  
to keep out wet.

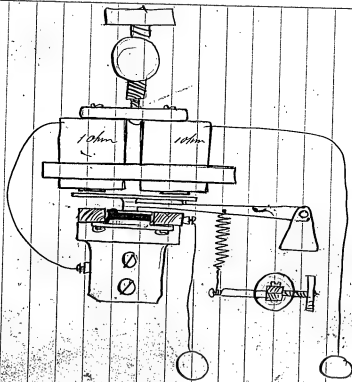
Wire Telephone  
Rubber

June 21 1878

Thomas A Edison  
Patent Attorney  
J. H. ...



cup inside 2 1/6 3/8 Dia



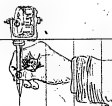
Automatic Current regulator  
with magnet and Carbons

June 21 1878

Thos A Edison  
Charles Edison  
J. Harrison



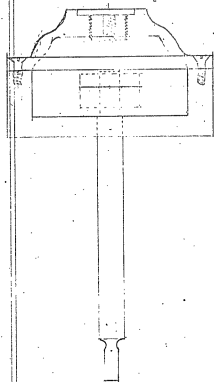




Carbon Reposter June 21<sup>st</sup> 1888

J. H. Kneass

Char. Batcher



Spring Migration

[illegible]

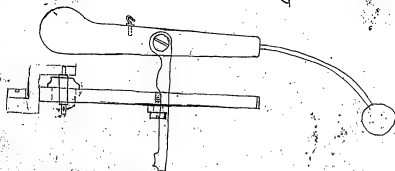
Ex. E. M.  
T. Edison

Received money under Oct 10. 1878

Ed. & Herman

M. N. Stone

Ed. & Herman  
M. N. Stone



Colo 714  
Electro Molygraph Co. 10.79

J. H. H. H. H.

Wire  
1" long 8 square

10000  
10000

10.0000

8/2000

15/250

10.0000

10.0000

10.0000

10.0000

600 16.

34 71

25.

10.0000

10.0000

10.0000

2000 feet  
151.00  
625.00 small 1250 wires.  
625.00  
21.00  
51.250  
2562.50  
51.250

781.250

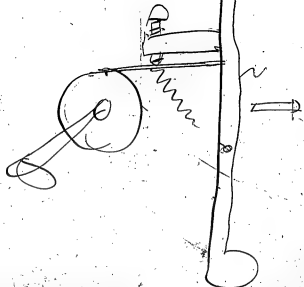
.4567  
2.2701  
30  
24  
64  
467  
212

Cost of wire for 25 Stations  
Machine  
\$200.00

781.250

250.000

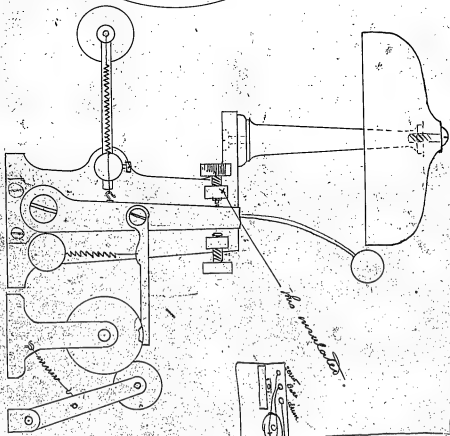
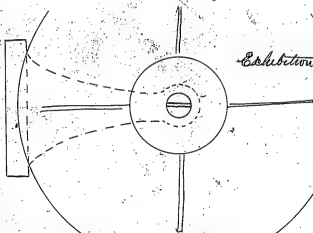
25  
200  
5000  
15.000  
75.000  
150.000



Exhibition Electromagnets

Oct 10 / 1898

Wm A Edison  
Charles B. Williams  
J. H. P. Morse  
M. M. Force



15/16

Electro-matograph - Dec 10, 1878

Y. A. Eliason -  
G. E. Coleman

Martin R. Ford  
W. H. Ketchel  
J. H. Kesi



Jalilov

Electronics and  
Radio

M. N. Dore

Charkovskiy  
Jalilov





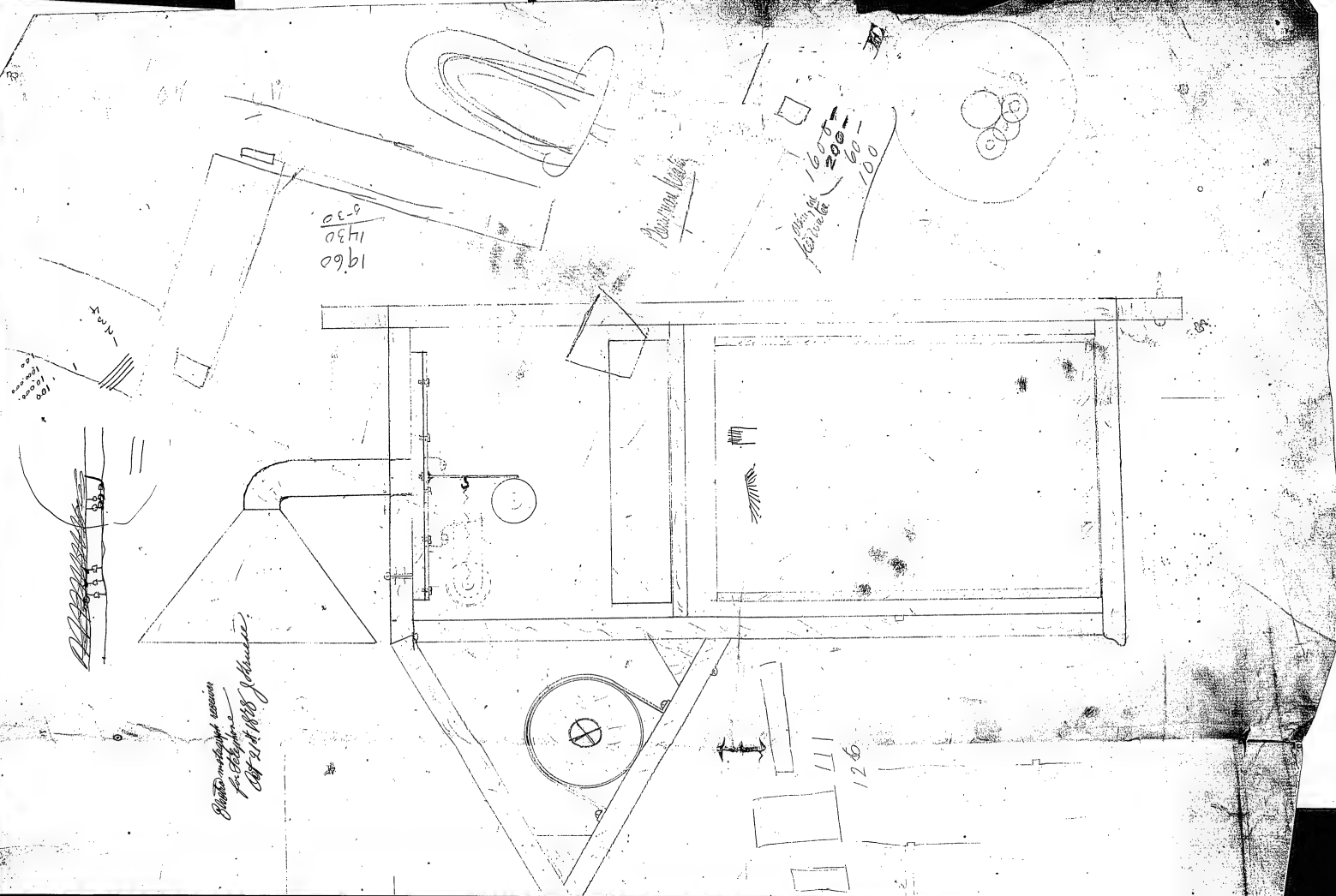
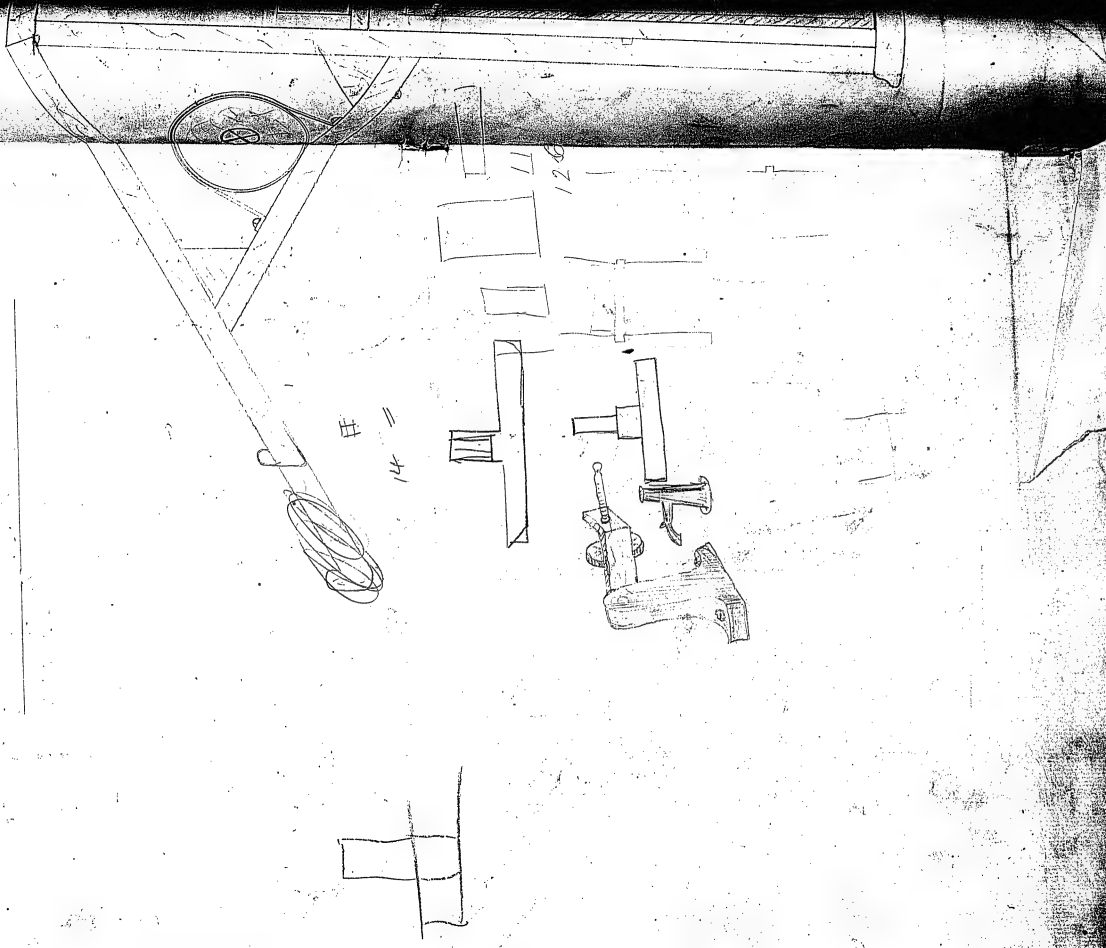


Photo Montage  
1955  
Oct 21, 1958  
Johnnie

1 1/2

[CONTINUED FROM THE PRECEDING FRAME]

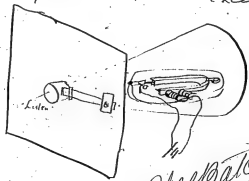


1878. Voltmeter (NS-78-012)

Numbered pages 1-22, which precede the other notes and drawings, were copied into Experimental Researches, Vol. 4, pages 175-192. The first page in this series seems to relate to an acoustic device rather than to the voltmeter.

June 21 1878

Narrow aperture leading from a Continuous <sup>at</sup> ~~Electric~~  
 source of sound & expansion of bubble <sup>Johnes</sup>  
 Closes aperture to give a <sup>Martin Force</sup> desired extent



Chas. Batchelor

The slot may be the same as a spectacle  
 and may be opened & closed by a magnet  
 galvanometer needle etc or by a strip  
 deriving motion from a diaphragm having  
 a concave shape

Personally appeared before me this day of  
 1878, the said Chas. A. Batchelor,  
 Chas. Batchelor, John Jones, and Martin Force,  
 and acknowledged the above to be their signatures

Notary Public

Edwin W. Jones 175 1878 & Chas. Batchelor  
 W. A. 1878  
 W. A. 1878

Donous Voltmeter Aug. 22, 1878.

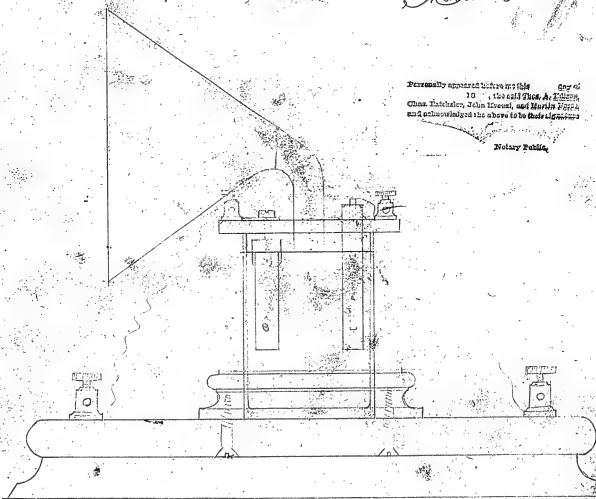
Noted on P. 96 Doc 4 Ed Rescues (1879)

Wm. Lamm

John  
Edna  
Chas. Batchelor  
Martin Force

Personally appeared before me this 10th day of Aug. 1878, the said Chas. A. Batchelor, Chas. Batchelor, John Lamm, and Martin Force, and acknowledged the above to be their signatures.

Notary Public



1/16

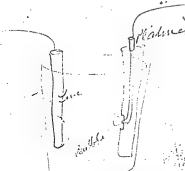
Voltmeter  
Edison

Aug 29 1848 3

Charlottesville

With Instrument made so

on Sharp <sup>Johnson</sup> Martin & Poma



1 Drop released in 10 seconds

1 " " " " 12 "

1 " " " " 14 "

1 " " " " 16 "

1 " " " " 18 "

1 " " " " 20 "

1 " " " " 22 "

1 " " " " 24 "

1 " " " " 26 "

1 " " " " 28 "

1 " " " " 30 "

1 " " " " 32 "

1 " " " " 34 "

1 " " " " 36 "

1 " " " " 38 "

1 " " " " 40 "

1 " " " " 42 "

1 " " " " 44 "

1 " " " " 46 "

1 " " " " 48 "

1 " " " " 50 "

1 " " " " 52 "

1 " " " " 54 "

Personally appeared before me this day of 1848, the said Charles Johnson, Martin & Poma, and others, who acknowledged the above to be their signatures.

Notary Public.

3 Cells Carbon 1/2  
in it

Edison Aug 17 1848  
Edison Aug 17 1848  
Edison Aug 17 1848  
Edison Aug 17 1848

After this we put in current 100 ohms  
1 drop 12 1/2 seconds

Now 30 ohms in current  
1 drop in 16 seconds 16 1/2  
1 " " 13 seconds 13 1/2

Voltameter (Continued)

Aug 29 1898

Charzatchick

With one hundred ohms in circuit

1 Drop in 16 1/2 seconds  
 1 Drop " 16 1/2 "  
 1 Drop " 17 1/2 "  
 1 Drop " 16 1/2 "  
 1 Drop " 15 3/4 "  
 1 " " 16 - "  
 1 " " 16 3/4 "

Personally appeared before me this 10 day of  
 Chas. H. [unclear] John Kernal, and Martin [unclear]  
 and [unclear] [unclear] above to be their signatures

Notary Public

2  
 4  
 6  
 8  
 10  
 12  
 55  
 42  
 97

With 200 ~~ohms~~ ohms

1 Drop in 20 seconds  
 1 " " 20 3/4 "  
 1 " " 19 3/4 "  
 1 " " 19 3/4 "  
 1 " " 20 "

84  
 2 1/2  
 12

56 1/2  
 27  
 76 1/2

With 400 ohms in

1 Drop in 27 seconds  
 1 Drop in 26 1/2 seconds

With 600 ohms in

1 Drop in 34 seconds  
 1 " " 34 seconds  
 1 " " 34 1/4 seconds

With 1200 ohms in

1 Drop in 54 3/4 Sec  
 1 " " 53 1/2 "

21 5 1/2  
 54

Witnesses on Aug 29 1898 J. E. [unclear]  
 W. [unclear] 1898

100 Comical





Voltmeter

6

With 600 ohms in

1 Drop in	30	Sec
1 " "	31	Sec
1 " "	32	Sec
1 " "	33 $\frac{1}{2}$	Sec
1 " "	33 $\frac{3}{4}$	Sec
1 " "	34	Sec
1 " "	33 $\frac{1}{2}$	Sec

V. Edison  
Johnston  
Marion Force  
36  
702

Starts too soon

Put in one Carbon cell + 600 ohms

1 Drop in 168 seconds

244 34 248 7  
34 168 4  
32

Nearly 5 times as long as with 3 cells

probably due to polarization. Hensen (Investigate!)

1 Drop in 164  $\frac{3}{4}$  seconds

56:100 100  
56:168 20  
100  
100  
56:130

Put in one Calland cell in 600 ohms

1 Drop in 12 minute 7  $\frac{1}{2}$  seconds -

Refused on p. 150 line 5  
Exp. 100 ohms 100 ohms

Good night

Tolson  
Chapman

Cathodic  
Voltameter.

Aug 31<sup>st</sup> 1898

Charles Batchelor  
J. H. Kneese

This is the best way for the gas to come from  
the electrode.



No the pressure will always vary inside  
chamber

Personally prepared before me this  
12  
Charles Batchelor, John Kneese, and Martin Force,  
and acknowledged the above to be their signatures

Notary Public.

Approved on Aug 100 Use it by Kneese  
Per 9. 1898 W. C. Cannon

Buck's Vallimur

Sept 13, 1878

Time, 3 cells called shot ck

HO 411P

70 Edison

Sharp Patchy for

John Russell  
Martin Force

Personally appeared before me this  
13<sup>th</sup> day of Sept. 1878  
Chas. Hatcher, John Russell, and Martin Force,  
and acknowledged the above to be their signatures.

Notary Public.

Copied in page 181 Vol. 4 of the  
Court 9, 1877 1878

64

64

64

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64

fine bubbles connect to rise between large bubble  
hence the variation

Closed part of the hole up to  
prevent the above

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Rev. A. J. ...

$\frac{6^3}{4}$

Σελ

Observe small bubbles  
escaping from hole in  
paper -

Small bubble slaps

J. A. Edson

4  $\frac{3}{4}$  Chat Batchelor  
5  $\frac{1}{2}$   $\frac{4}{5}$   $\frac{1}{2}$   $\frac{4}{5}$   
5 Martin Phoebe  
5  $\frac{5}{8}$

Personally appeared before me this                      day of  
19                      the said John A. Wilson,  
John Bachelor, John Brown, and Martha Brown,  
and acknowledged the above to be their signature

Notary Public.



Bubble Voltmeter

Sept. 13 13

Test Electrostatic force

Jalldeson

3 cell ball and small size  
see over average

100 ohm constant  
13 sec  
Johnney  
Martin Pora

3 cell Carbon

100 ohm Constant

Lecher on P. 186 Vol. 4. E. A. Hansen. Copy 179

179

3 3/4 Sec

3 3/4

3 3/4

3 3/4

3 3/4

3 3/4

3 3/4

4

4

4

4

4 1/2

4 1/2

4 1/2

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4 1/2

4 1/2

Previously approved before on this day of  
19, the said John A. Hansen,  
Chas. H. Hansen, John A. Hansen, and Charles Hansen,  
and acknowledged the above to be their signatures.

Notary Public.



Bubble Voltmeter  
 Tests to obtain Electric machine force  
 10 Cells. Calland Constant  
 1000 Turns

Steps to obtain Electric motor Horse

10 Cell. Calland Constant

Sept 15 14  
Butter  
Garden  
100 - 100

[illegible]

Copied on May 2 1876  
Decr 4, 1878

Small bubble  
going up

on 400 shilling account, 8,

Test 2



Voltmeter

Sept- 14- 28

Porous Diaphragm

McEduy

Paper -

So soft gas appears to  
burst it after 2 hours

Gold Beaten Skin

Better but softens by use  
and becomes useless.


Cork

No better

Chas. B. Botsford  
J. H. Huggins  
Morris Force

CCCCC

CCCCC

Stopped up the hole top of the  
cell and fixed a Celluloid face  
to the cell with hole at top  
& bottom thus  - Thus collecting  
the gas in the hole of the cell.  
this also prevents the escape of  
small bubble from the face of  
station disc.

after giving an above record  
have given

Personally appeared before me this 10th day of Sept. 1928, the said Chas. B. Botsford, J. H. Huggins, and Morris Force, and acknowledged the above to be their own and true signatures.

Notary Public

Sketches in pages 189, 190 & 191. B. B. Botsford  
Oct 4, 1928 M. C. C. C.

T. A. EDISON.

Menlo Park, N. J.,

17  
Sept 16<sup>th</sup> 1878

*Volta meter*

*T. A. Edison*

*Celluloid*

*Chaffee & Tschala  
Mention Time*



Testimony appeared before me this day of  
1878, the said T. A. Edison,  
Wm. Datchelor, John Krouse, and Martin Force,  
did acknowledge the above to be their signatures

Notary Public,

*Copied and 1898  
Vol 4 Exp Research  
over 9,187*

Bubble Voltmeter

Sept 16. 78

Yardley

After Instrument working over night -  
found heavy blackish deposit on the  
negative electrode. possibly from the Carbon  
used (Solution Hydrochloric Acid) -

~~As the liquid was not affected~~  
~~by the deposit~~

Used fine platinum wire in place of  
the Carbon rod.

Result was the more even <sup>deposition</sup> <sup>of hydrogen</sup> gas  
off of gas at negative pole  
probably this is comes from the fact -  
that the wire gives off its oxygen  
with more regularity than the  
Carbon

looked on p. 190 Vol. 9 Constance  
Sept 9. 1878 McClelland

Personally appeared before me this 10th day of Sept 1878 the said Thos. A. Yardley, Chas. Hutchins, John Brown, and Charles Taylor, and acknowledged the above to be their signature

Notary Public.



# Radiation of Heat

20

*Verdun Johnson*  
Miner

Source of Heat	Direct Radiation	Liquid introduced in Anemograph	Radiation	Per Cent Retained
Gas jet	200°	4.	55°	
" "	200°	9.	65°	

Personally appeared before me this 20th day of Sept. 1918, the said Verdun A. Johnson, Chas. E. Schuler, John Dwyer, and Martin Force, and acknowledged the above to be their signature.

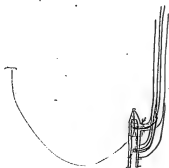
Notary Public.

Exhibit on Page 2191, Vol. 4  
Lyon Bureau Oct 9, 1918  
M. B. Mason

Donor and Titular 21  
Sept 1898

J. Russo  
Chapman

J. Russo  
Martin F. F.



Personally appeared before me this day of  
1898, the said J. Russo, Chap.  
Chas. Hatchler, John Russo, and Martin F. F.,  
and acknowledged the above to be their signature

Notary Public.

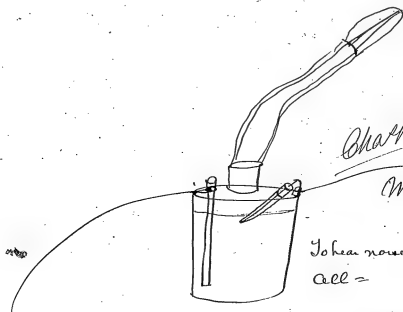


Copies on page 191 of 4 Encl. Recor. 1898  
Cor. 9, 1898  
J. Russo



Voltmeter Sept 27, 1898

garden



Chas. Batchelder  
J. H. Kinsley  
Martin Force

To hear noise in decomposition  
all =

Personally appeared before me this day of  
1898, the said Chas. A. Batchelder,  
Chas. Batchelder, John Kinsley, and Martin Force,  
and acknowledged the above to be their signatures

Notary Public

Looked over page 192 Vol 4. Exp Researches

Oct 9, 1898

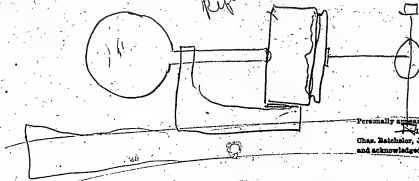
W. C. Farnham

#9

Sept 27 1878

7as

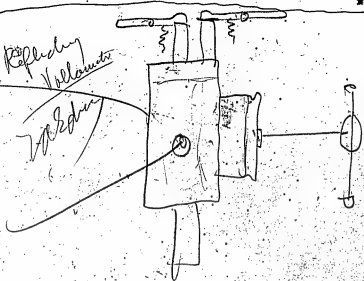
Reflecting Thermoscope  
7as  
Martin Force  
Johnnie  
M. N. Force



Personally appeared before me this day of Sept 27, 1878, the said Chas. A. Edison, Chas. Batchelor, John Kruet, and Martin Force, and acknowledged the above to be their signature

Notary Public.

Reflecting  
Volant  
7as Edison



T. A. EDISON.

Volta Bureau

Sept 20, 1899

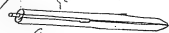
Menlo Park, N. J.

187

Thurs



Will you have made  
immediately the following:-  
instead of the platinum coming  
out of side of rubber electrode  
in this instrument make  
one this way:



that is put a thin  
platinum core into the  
thick piece and cover  
the whole with rubber  
or take a thinner piece  
of wire all through and cover with  
rubber and then bend off the end  
so that only the extreme end  
is seen and then warm rubber &  
bend round like sketch, afterward  
draw you would burnish the top  
of platinum so that the water  
will not stick to it (see Johnson)

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**END**

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A SELECTIVE MICROFILM EDITION

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(1850-1878)

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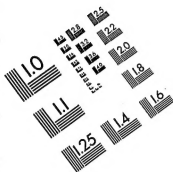
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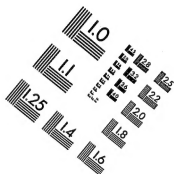
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Centimeter



Inches

